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ABSTRACT

This curriculum guide was designed for use in postsecondary drafting/design technology education programs in Georgia. Its purpose is to provide for development of entry level skills in drafting/design technology in the areas of knowledge, theoretical structure, tool usage, diagnostic ability, related supportive skills, and occupational survival skills. The first section of six explains the philosophies, purposes, and goals of vocational education in Georgia. Section 2 presents employability skills related to the occupational area of drafting/design technology, specific occupational titles, student exit points, and tasks cross referenced to the Dictionary of Occupational Titles. Section 3, the largest part of the guide, provides unit guides for each task. (For each task, a task description, student performance objective, suggested instructional activities, instructional materials, evaluation section, and suggested instruction hours are included.) Section 4 contains the curriculum structure and course outline, while student record forms and competency certificates make up section 5. The last unit contains facility guidelines, with drawings, for group instruction and individualized instruction facilities. Appendixes to the guide contain references and resources, information on teaching special needs students, and definitions of terms. (KC)

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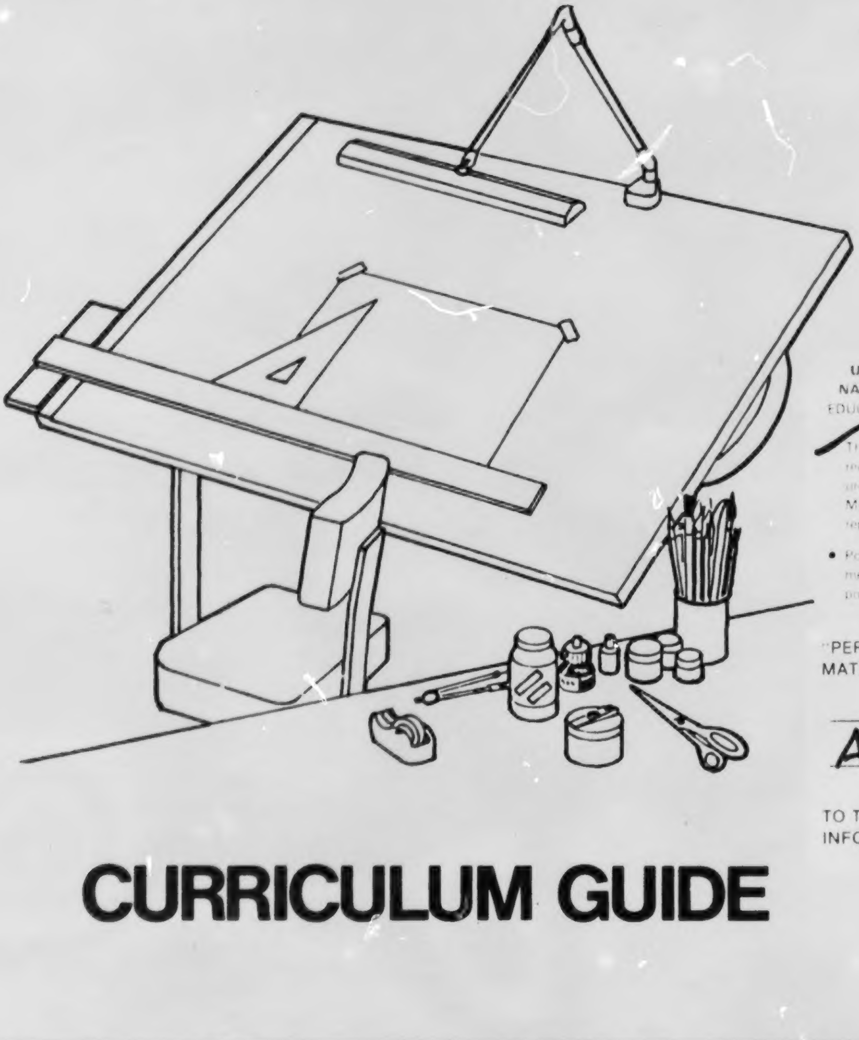
DRAFTING/DESIGN TECHNOLOGY

Post Secondary



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CURRICULUM GUIDE

Georgia Department of Education

DRAFTING/DESIGN TECHNOLOGY

Developed Under Contractual Agreement with

Division of Program Development
Office of Vocational Education
Georgia Department of Education
Atlanta, Georgia 30334
Charles McDaniel, State Superintendent of Schools
1981

DRAFTING/DESIGN TECHNOLOGY

Developed By

The University of Georgia

Under the Direction of

Dr. Paul Scott

Vocational Education Materials Center

Division of Vocational Education

College of Education

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POLICIES AND PROCEDURES FOR THE CENTER

PURPOSE OF THE CENTER

The Vocational Education Materials Center functions within the division of Vocational Education, University of Georgia. This Center operates under grants from the U.S. Office of Education, and the Georgia State Department of Education with the support of the College of Education. The Center is comprehensive in its commitment and approach to the development and dissemination of materials in the broad field of Vocational Education.

The purpose of the Center is to increase the capability of Georgia's delivery system for Vocational Education. Specifically, the Center is committed to:

1. Develop materials to assist in the implementation of proposed curricula and to enhance the teaching Vocational Education.
2. Conduct and report curriculum research related to Vocational Education.
3. Provide a production and dissemination center to Vocational Education materials.
4. Provide direct experiences in curriculum development and diffusion for advanced graduate stduents.
5. Enable faculty members to participate in the development and implementation of a variety of curriculum materials.

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PURPOSE AND UTILIZATION OF THE CURRICULUM GUIDES

The purpose of this curriculum guide is to provide a suggested model for organizing vocational instructional content. In many cases, more material is available than may be needed, therefore, an instructor will need to adapt the content to meet his/her program needs.

While the guide is primarily oriented towards the classroom, whether as a primary resource or as a supplement to other teaching materials; it may also assist administrators, counselors and lay people involved in local school systems. The following outline provides an overview of the various ways these groups may utilize the curriculum guides.

a) Vocational teachers.

1. Provide a guide for organizing their program of instruction,
2. Assist in establishing program objectives,
3. Serve as a curriculum materials resource guide,
4. Improve communications with employers and advisory committees
5. Facilitate competency based instruction,
6. Facilitate either group or self-paced instruction,
7. Include content by quarter and semester,
8. Cross-reference with existing state developed instructional materials (PLACE packages and post secondary I.I.).

b) Vocational supervisors and administrators.

1. Assist in defining the scope and content of their programs,
2. Provide a means to improve curriculum management functions,
3. Serve as a guide for admissions and job placement functions,
4. Improve communications with employers and advisory committees.

c) Counseling and guidance staff.

1. Provide a data base for counseling and guidance personnel,
2. Identify student exit points (Career Options),
3. Serve as guide for admissions and job placement,

4. Correlate with new State Board of Education graduation requirements,
5. Provide specific content sequencing by quarter and semester for student scheduling,
6. Provide (a) curriculum options for the disadvantaged handicapped student, (b) curriculum modifications for SPECIAL NEEDS students, (c) typical admission requirements for regular and SPECIAL NEEDS students.

(d) Local Curriculum Coordination Committees.

1. Serve as a guide in working out articulation arrangements,
2. Improve definitions of the relationship between secondary clusters and post secondary specialized programs.

Vocational teachers, supervisors and administrators, counseling and guidance staff and local curriculum coordination committees will be primary users of this guide, however, the use of the guide is not limited to these groups, but by any and all groups directly related in designing a vocational curriculum.

-Foreword-

It has been the privilege of the Division of Vocational Education, University of Georgia, to participate in the development of 48 curriculum guides for Georgia vocational education programs. This work was sponsored by the Division of Program Development, Office of Vocational Education, State Department of Education. The completion of these guides meets a long standing need to provide a comprehensive curriculum overview of the vocational education programs available in Georgia schools. This developmental activity involved one of the largest professional staffs ever assembled for such work. Numerous teachers, teacher educators and state staff members have either written parts of the guides or served on the field review teams. These professionals were supported by a myriad of technical people and a host of typists who literally worked from dawn to dusk to ensure that the guides were produced in a timely fashion.

Be assured that this guide is not intended to be your curriculum or the curriculum of any school. The purpose of this project staff, and I am sure of the state OVE staff, is to offer a guide with supporting resources and teaching ideas from which the vocational instructor can extract a curriculum that meets local needs. The guide, however, does simplify curriculum decisions concerning sequencing and the selection of resources and media support.

The Task Linkage Project and appropriate V'TECS catalogs were used as the beginning point for this guide and all of the others. To assure that these task listings were directly related to Georgia vocational education programs and industry, they were subjected to additional study and review by appropriate teachers.

At some point in the future, this guide will need to be revised. To ensure that such a revision truly reflects the needs of Georgia's vocational education programs, the developers need your reactions, comments and ideas. We will also be interested in how you use this guide. Let us hear from you.

Paul Scott
Curriculum Guide Projects I & II

SECTION I

PHILOSOPHY, PURPOSE & OBJECTIVES

SECTION I

Section I Content List

State Philosophy and Goals
Local Philosophy and Goals

Section I provides an overview of the philosophies, purposes and goals for vocational education in the State of Georgia. These are applied to vocational education at the postsecondary level, however, it is recognized that more specific philosophies, purposes and goals will be applicable depending on the character of the local program.

VOCATIONAL EDUCATION IN GEORGIA

A. PHILOSOPHY

The Georgia Board of Education perceives vocational education as a vital component in the education of the young and adult citizens of this State. Appropriate programs of vocational education and ancillary services should be made readily available to individuals in middle schools, vocational divisions of junior colleges, vocational centers, the Quick Start program and other adult programs designed to train or retrain workers for useful and satisfying employment.

Special services and assistance must be provided to those who need it in order to participate or benefit from vocational education. This includes women, minorities, the displaced homemaker and other displaced workers, those with limited English-speaking ability, the disadvantaged and the handicapped.

Since men and women spend the greater part of their lives at some form of work, the State should provide opportunities for all its citizens to develop the knowledge, skills and attitudes necessary for them to secure personally satisfying and socially useful employment.

B. PURPOSE

The purpose of vocational education shall be to improve the economic well-being of Georgia citizens by preparing individuals, through organized learning experiences, to select, obtain and advance in recognized occupations.

POSTSECONDARY VOCATIONAL EDUCATION

A. PURPOSE

The purpose of postsecondary vocational-technical education in Georgia is to improve the economic well-being of adult citizens by providing access to high quality vocational-technical training for skilled and semi-skilled occupations, for improvement of existing skills or for retraining in a new occupation.

B. OBJECTIVES

1. To provide vocational-technical education programs and ancillary services commensurate with the needs and interests of students and available job opportunities.

2. To provide vocational-technical education programs which are current with the state-of-the-art, competency-based, and offer multiple exit points to accommodate the students' occupational objectives.

3. To provide vocational-technical education programs which are articulated with available high school counterparts, to facilitate an easy transition from secondary to postsecondary levels without loss of credit.

4. To provide vocational-technical education programs such that 75% of those individuals who leave or complete a program of occupational preparation will find employment in the field, or a related field, for which trained.

5. To provide those guidance, counseling, financial aid, evaluative, job placement, remedial and other supportive programs and services needed by students to enroll, complete a program and become, or remain, employable in a skilled or semi-skilled occupation.

6. To provide needed assistance to special populations to include women, minorities, limited English-speaking, the displaced homemaker and other displaced workers, the disadvantaged and the handicapped.

7. To provide vocational-technical education programs for full-time and part-time students on campus during the day as well as the evening hours, and to provide appropriate programs for full-time and part-time students off campus in businesses and industries, comprehensive high schools and other locations within the respective schools' service areas.

8. To serve as a center for the delivery of postsecondary and adult vocational-technical education programs and services for the community and assigned service area.

STATEMENT OF LOCAL SYSTEM PHILOSOPHY, PURPOSE AND OBJECTIVES FOR VOCATIONAL EDUCATION

(This page is intentionally left blank so that local systems may insert their copy of philocophy, purpose and goals for vocational education.)

SECTION II

PROGRAM DESCRIPTION & RELATED INFORMATION

SECTION II

Section II Content List

Employability Skills
Drafting/Design Technology Occupational Description
Drafting/Design Technology Program Objective
Definition of the D.O.T. Code
Description of Drafting/Design Technology D.O.T.
Task Listing by D.O.T. Code

The major goal of vocational education in Georgia is to prepare individuals, through organized learning experiences, to select, obtain and advance in recognized occupations. Section II provides an overview of employability skills that are desirable in any occupation and relates their significance to the specific occupational area of the Drafting/Design Technology.

The Drafting Design Technology Program Objective contains the specific occupational titles. These occupational titles are further explained in the description of the occupational exit points and task listing. The concentration of the program is based on these tasks.

Also included in this section are the "performance standards" that a student is expected to master before graduating from any Georgia secondary school.

EMPLOYABILITY SKILLS

Employability skills exert a great deal of influence on a person's ability to get and keep a job. Surveys indicate that more people lose their jobs because of poor attitudes toward their job than for lack of job skills. For this reason it is important that information concerning the following employability skills be provided as an ongoing part of the program.

1. Getting a job
    a. Filling out job applications
    b. Developing a resume
    c. Preparing for a job interview

2. Keeping a job
    a. Be on time and regular in attendance
    b. Maintain a fair share of the work-load
    c. Work without supervision
    d. Meet production schedules
    e. Properly care for and use equipment
    f. Dress appropriately for the job
    g. Maintain good personal hygiene
    h. Develop and maintain good communication with supervisors and co-workers

A recent study sponsored by the Illinois Department of Adult, Vocational and Technical Education and conducted by the University of Illinois, "Survival Skills: Mastering the Human Aspects of Work", has identified twelve topics that might be developed into instructional modules for teaching occupational survival skills. The author, Robert E. Nelson, outlines these topics listed below and on the next page, each followed by a general objective which indicates the relationship between the topic and the survival skills required to maintain a job.

*"1. Working in an Organization: To familiarize students with the reasons for the formation of organizations and the common characteristics of organizations.

2. Understanding Self and Others: To have students develop insights into causes of human behavior and learn to interpret their own behavior and the behavior of other.

3. Motivation for Work: To have students develop and understanding of motivations into the work they perform.
4. Interpersonal Relations: To have students develop concepts and skills in interpersonal relations and apply them to work situations.
5. On-the-Job Communication: To have students understand the importance of effective communication and learn ways of communicating effectively on the job.
6. Using Creativity on the Job: To make students aware of their creative potential and to practice using their creative ability in hypothetical on-the-job situations.
7. Authority and Responsibility: To have students develop an understanding of the concepts of authority, power, influence, and responsibility as they apply to work situations.
8. Problem Solving: To have students develop skill in applying problem solving to their work.
9. Coping with Organizational Change: To make students aware of the process of organizational change and the techniques for coping with organizational change.
10. Coping with Organizational Conflict: To make students aware of the sources and types of conflicts encountered on the job and recognize ways of coping with conflicts in an organization.
11. Leadership: To have students recognize the need for leadership in work groups and increase their understanding of the leadership role in work situations.
12. Adapting and Planning for the Future: To have students develop perspectives of work in the future and the ability to plan for anticipated changes in their work roles."

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*Abstracted from the article, "Survival Skills: Mastering the Human Aspects of Work," by Robert E. Nelson, American Vocational Journal, November 1977.

DRAFTING/DESIGN TECHNOLOGY*

Nature of Work

When building a satellite, television set, or bridge, workers follow drawings that show the exact dimensions and specifications of the entire object and each of its parts. Workers who draw these plans are drafters.

Drafters prepare detailed drawings on rough sketches, specifications, and calculations made by scientists, engineers, architects, and designers. They also calculate the strength, quality, and cost of materials. Final drawings contain a detailed view of the object from all sides as well as specifications for materials to be used, procedures followed, and other information to carry out the job.

In preparing drawings, drafters use compasses, dividers, protractors, triangles, and other drafting devices. They also use technical handbooks, tables, and calculators to help solve problems.

Drafters are classified according to the work they do or their level of responsibility. Senior drafters translate an engineer's or architect's preliminary plans into design "layouts" (scale drawings of the object to be built). Detailers draw each part shown on the layout, and give dimensions, materials, and other information to make the drawings clear and complete. Checkers carefully examine drawings for errors in computing or recording dimensions and specifications. Under the supervision of experienced drafters, tracers make minor corrections and trace drawings for reproduction on paper or plastic film.

Drafters usually specialize in a particular field of work, such as mechanical, electrical, electronic, aeronautical, structural, or architectural.

Working Conditions

Although drafters usually work in well-lighted and well-ventilated rooms, they often must sit and do very detailed work for long periods of time. This work may cause eye strain.

Places of Employment

More than 9 out of 10 drafters work in private industry. Engineering and architectural firms are the single largest employers of drafters. Other major employers include the fabricated metals, electrical equipment, machinery, and construction industries.

About 7% of the drafters nationwide are employed by Federal, State and local governments. Most drafters in the Federal Government work for the Defense Department; those in State and local governments are mainly in highway and public works departments. Some drafters work for colleges and universities and non-profit organizations.

Training, Other Qualifications, and Advancement

Persons interested in becoming drafters can acquire the necessary training in technical institutes, junior and community colleges, extension division of universities, and vocational and technical high schools. Some persons receive training and experience in the Armed Forces. Others qualify through on-the-job training programs combined with part-time schooling or 3-to-4 year apprenticeship programs.

Training for a career in drafting, whether in a high school or post high-school program, should include courses in mathematics, physical sciences, mechanical drawing, and drafting. Shop practices and shop skills also are helpful since most higher level drafting jobs require knowledge of manufacturing or construction methods. Many technical schools offer courses in structural design, architectural drawing, and engineering or industrial technology.

Those planning careers in drafting should be able to do free hand drawings of three-dimensional objects and also detailed work requiring a high degree of accuracy. They should have good eye sight and manual dexterity. In addition, they should be able to function as part of a team since they work directly with engineers, architects, and craft workers. Artistic ability is helpful in some specialized fields.

High school graduates usually start out as tracers. Those having post-high school technical training may begin as junior drafters. After gaining experience, they may advance to checkers, detailers, senior drafters, or supervisors. Some may become independent designers. Courses in engineering and mathematics sometimes enable drafters to transfer to engineering positions.

Employment Outlook

Employment of drafters is expected to increase as fast as the average for all occupations through the 1980's because of industrial growth and the increasingly complex design problems and processes. Openings will also result from the need to replace drafters who retire, die or move into other fields of work.

Holders of an associate (2-year) degree in drafting wil have the best prospects. Many large employers already require post-secondary technical education, though well-qualified high school graduates who have studied drafting may find opportunities in some types of jobs. Photo-reproduction of drawings and the expanding use of electronic drafting equipment and computers, however, will reduce the need for less skilled drafters.

Sources of Additional Information

General information in careers for drafters is available from:

American Institute for Design and Drafting
3119 Price Road
Bartleville, Oklahoma 74003

International Federation of Professional and Technical Engineers
1126 16th Street, N.W.
Washington, D.C. 20036

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*Occupational Outlook Handbook, 1980 ed.

DRAFTING/DESIGN TECHNOLOGY PROGRAM OBJECTIVE

Given appropriate instruction, as suggested by this guide, a student completing the program should demonstrate entry level skills in Drafting/Design Technology occupations in the areas of knowledge, theoretical structure, tool usage, diagnostic ability, related supportive skills and occupational survival skills.

As the student progresses through the program, sufficient competencies will be acquired to enable the student to enter the occupational field at the following D.O.T. Codes.*

Drafter, Assistant	(D.O.T. Code 017.281-018)
Drafter, Apprentice	(D.O.T. Code 017.281-014)
Drafter, Electrical	(D.O.T. Code 003.281-010)
Drafter, Electronic	(D.O.T. Code 003.281-014)
Drafter, Heating and Ventilating	(D.O.T. Code 017.261-034)
Drafter, Plumbing	(D.O.T. Code 017.261-038)
Drafter, Commercial	(D.O.T. Code 017.261-026)
Drafter, Structural	(D.O.T. Code 005.281-014)
Detailer	(D.O.T. Code 017.261-018)
Drafter, Mechanical	(D.O.T. Code 007.281-010)
Drafter, Architectural	(D.O.T. Code 001.261-010)
Drafter, Civil	(D.O.T. Code 005.281-010)

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*Dictionary of Occupational Titles

DEFINITION OF D.O.T. CODE*

As a result of technological, economic and sociological influences, nearly every job in the economy is performed slightly differently from any other job. Every job is also similar to a number of other jobs. In order to look at the millions of jobs in an organized way, job titles are designated a 9-digit occupational code. Each set of three digits in the D.O.T. Code has a specific purpose or meaning that differentiates it from all other codes.

The first three digits of the D.O.T. Code identify a particular occupational group. In the code 652.382-010, the first digit indicates an occupational category. The second digit refers to a division within the occupational category. The third digit defines a specific occupational group within a division.

The middle three digits of the D.O.T. Code 652.382-010 are the worker function rating of the tasks performed in the occupation. Every job requires a worker to function, to some degree, in relation to data, people and things. A separate digit expresses the worker's relationship to each of these three groups. Worker functions involving more complex responsibility and judgment are assigned lower numbers while functions which are less complicated have high numbers.

The last three digits of the D.O.T. Code 652.382-010 indicate the alphabetical order of titles within 6-digit code groups. They serve to differentiate a particular occupation from all others. A number of occupations may have the same first six digits, but no two D.O.T. Code can have the same nine digits.

*Dictionary of Occupational Titles, 1977 ed.

DESCRIPTION OF OCCUPATIONAL EXIT POINTS*

DRAFTER (Master Title and Definition)

Prepares clear, complete and accurate working plans and detail drawing from rough or detailed sketches or notes for engineering or manufacturing purposes, according to specified dimensions: Makes final sketch of proposed drawing, checking dimension of parts, materials to be used, relation of one part to another and relation of various parts to whole structure or project. Makes any adjustments or changes necessary or desired. Inks in lines and letters on pencil drawings as required. Exercises manual skill in manipulation of triangle, T-square and other drafting tools. Draws charts for representation of statistical data. Draws finished designs from sketches. Utilizes knowledge of various machines, engineering practices, mathematics, building materials and other physical sciences to complete drawings. Classifications are made according to type of drafting as Drafter, Architectural or Drafter, Electrical.

APPRENTICE (Master Title and Definition)

A worker who learns, according to written or oral contractual agreement, a recognized skilled craft or trade requiring one or more years of on-the-job training through job experience supplemented by related instruction, prior to being considered a qualified skilled worker. High school or vocational school education is often a prerequisite for entry into an apprenticeship program. Provisions of apprenticeship agreement regularly include length of apprenticeship, a progressive scale of wages; work processes to be taught; and amount of instruction in subjects related to the craft or trade, such as characteristics of materials used, physics, mathematics, estimating and blueprint reading. Apprenticeability of a particular craft or trade is best evidenced by its acceptability for registration as a trade by a State apprenticeship agency or the Federal Bureau of Apprenticeship and Training. Generally, where employees are represented by a union, apprenticeship programs come under the guidance of joint apprenticeship committees composed of representatives of the employers or the employer association and representatives of the employees. These committees may determine need for apprentices in a locality and establish minimum apprenticeship standards of education, experience and training. In instances where committees do not exist, apprenticeship agreement is made between apprentice and employer or an employer group. The title Apprentice is often loosely used as a synonym for beginner, Helper or Trainee. This practice is technically incorrect and leads to confusion in determining what is meant. Typical classifications for apprentices are Blacksmith Apprentice, Machinist Apprentice and Plumber Apprentice.

017.281-018 DRAFTER, ASSISTANT

Copies plans and drawings prepared by Drafter by tracing them with ink and pencil on transparent paper or cloth spread over drawings, using triangle, T-square, compass, pens and other drafting instruments. Makes simple sketches or drawings under close supervision.

017.281-014 DRAFTER, APPRENTICE

Performs duties as described under apprentice.

003.281-010 DRAFTER, ELECTRICAL

Drafts electrical equipment working drawings and wiring diagrams used by construction crews and repairmen who erect, install and repair electrical equipment and wiring in communications centers, power-plants, industrial establishments, commercial or domestic buildings or electrical distribution systems, performing duties as described under Drafter.

003.281-014 DRAFTER, ELECTRONIC

Drafts wiring diagrams, schematics and layout drawings used in manufacture, assembly, installation and repair of electronic equipment, such as television cameras, radio transmitters and receivers, audioamplifiers, computers and radiation detectors, performing duties as described under Drafter. Drafts layout and detail drawings of racks, panels and enclosures. May conduct service and interference studies and prepare maps and charts related to radio and television surveys. May be designated according to equipment drafted as Drafter, Radio.

017.261-034 DRAFTER, HEATING AND VENTILATING

Performs duties of Drafter, but specializes in drawing plans for installation of heating, air conditioning and ventilating equipment. May calculate heat loss and heat gain for buildings for use in determining equipment specifications, using slide rule and following standardized procedures. May specialize in drawing plans for installation of refrigeration equipment as Drafter, Refrigeration.

017.261-038 DRAFTER, PLUMBING

Performs duties of Drafter but specializes in drawing plans for installation of heating, air-conditioning and ventilating equipment. May calculate heat loss and heat gain for buildings for use in determining equipment specifications, using slide rule and following standardized procedures. May specialize in drawing plans for installation of refrigeration equipment as Drafter, Refrigeration.

017.261-038 DRAFTER, PLUMBING

Performs duties of Drafter but specialized in drawing of plans for installation of plumbing equipment.

017.261-026 DRAFTER, COMMERCIAL

Performs general duties of Drafter in all round drafting, such as laying out location of buildings, planning of arrangements in offices, large rooms, store buildings and factories and drawing of charts, forms and records. Paints and washes colored drawings when required.

005.281-014 DRAFTER, STRUCTURAL

Performs duties of Drafter by drawing plans and details for structures employing structural reinforcing steel, concrete, masonry, wood and other structural materials. Produces plans and details of foundations, building frame, floor and roof framing and other structural elements.

017.261-018 DETAILER

Drafts detailed drawings of parts of machines or structures from rough or general design drawings: Shows dimensions, material to be used and other information necessary to make detailed drawing clear and complete. Makes tracing of finished drawing on semi-transparent paper from which blueprints can be made. Performs other duties as described under Drafter. May specialize in preparing detail drawings for specific type of machine, structure or product.

007.281-010 DRAFTER, MECHANICAL

Drafts detailed working drawings of machinery and mechanical devices, indicating dimensions and tolerances, fasteners and joining requirements and other engineering data. Drafts multiple view assembly and sub-assembly drawings as required for manufacture and repair of mechanisms. Performs other duties as described under Drafter.

001.261-010 DRAFTER, ARCHITECTURAL

Performs duties of Drafter by drawing artistic architectural and structural features of any class of buildings and like structure: Delineates designs and details, using drawing instruments.

Confirms compliance with building codes. May specialize in planing architectural details according to structural materials used as Drafter, Tile and Marble.

005.281-010 DRAFTER, CIVIL

Drafts detailed construction drawings, topographical profiles and related maps and specification sheets used in planning and construction of highways, river and harbor improvements, flood control, drainage and other civil engineering projects, performing duties as described under Drafter. Plots maps and charts showing profiles and cross-sections, indicating relation of topographical contours and elevations to buildings, retaining walls, tunnels, overhead power lines and other structures. Drafts detailed drawings of structures and installations, such as roads, culverts, fresh water supply and sewage disposal systems, dikes, wharfs and breakwaters. Computes volume of tonnage of excavations and fills and prepares graphs and hauling diagrams used in earthmoving operations. May accompany survey crew in field to locate grading markers or to collect data required for revision of construction drawings. May be designated according to type of construction as Drafter, Reinforced Concrete or Drafter, Water and Sewage.

TASK LISTING BY D.O.T. CODE

In this section the occupational exit points from the curriculum are cross referenced with the tasks which are required for employment in each job title. On the line following each task an x appears in the column of each job title to which to task applies. All the tasks listed in this matrix are taught in the curriculum presented in this guide. A detailed treatment of each task appears in the Unit Guides section of this curriculum guide.

TASK LISTING BY DOT CODE

Drafting/Design Technology

POSSIBLE EXIT POINTS

	DOT DESCRIPTION	Drafter, Assistant	Drafter, Apprentice	Drafter, Electrical	Drafter, Electronic	Drafter, Heating and Ventilating	Drafter, Plumbing	Drafter, Commercial	Drafter, Structural	Detailer	Drafter, Mechanical	Drafter, Architectural	Drafter, Civil
	DOT NO.	017.281-018	017.281-014	003.281-010	003.281-014	017.261-034	017.261-038	017.261-026	005.281-014	017.261-018	007.281-010	001.261-010	005.281-010
TASK NO.	TASK NAME												
Duty I - Theory of Shape Description													
SDI-01	Hand lettering	X	X	X	X	X	X	X	X	X	X	X	X
SDI-02	Sketching freehand	X	X	X	X	X	X	X	X	X	X	X	X
SDI-03	Analyzing drawings for acceptable drafting practice	X	X	X	X	X	X	X	X	X	X	X	X
SDI-04	Drawing plane figures	X	X	X	X	X	X	X	X	X	X	X	X
SDI-05	Drawing with line contrast	X	X	X	X	X	X	X	X	X	X	X	X
SDI-06	Drawing to scale	X	X	X	X	X	X	X	X	X	X	X	X
SDI-07	Drawing in orthographic	X	X	X	X	X	X	X	X	X	X	X	X

TASK LISTING BY DOT CODE

Drafting/Design Technology

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME	Drafter, Assistant 017.281-018	Drafter, Apprentice 017.281-014	Drafter, Electrical 003.281-010	Drafter, Electronic 003.281-014	Drafter, Heating and Ventilating 017.261-034	Drafter, Plumbing 017.261-038	Drafter, Commercial 017.261-026	Drafter, Structural 005.281-014	Detailer 017.261-018	Drafter, Mechanical 007.281-010	Drafter, Architectural 001.261-010	Drafter, Civil 005.281-010
SDI-08	Dimensioning	X	X	X	X	X	X	X	X	X	X	X	X
SDI-09	Drawing in isometric	X	X	X	X	X	X	X	X	X	X	X	X
Duty II - Theory of Shape Description II													
SDII-01	Drawing auxiliary views	X	X							X	X	X	X
SDII-02	Drawing fundamental views	X	X							X	X	X	X
SDII-03	Connecting skew lines	X	X							X	X	X	X
SDII-04	Locating piercing points	X	X							X	X	X	X
SDII-05	Drawing plane intersections	X	X							X	X	X	X
SDII-06	Determining dihedral angle	X	X							X	X	X	X

TASK LISTING BY DOT CODE

Drafting/Design Technology

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME	Drafter, Assistant	Drafter, Apprentice	Drafter, Electrical	Drafter, Electronic	Drafter, Heating and Ventilating	Drafter, Plumbing	Drafter, Commercial	Drafter, Structural	Detailer	Drafter, Mechanical	Drafter, Architectural	Drafter, Civil
	DOT NO.	017.281-018	017.281-014	003.281-010	003.281-014	017.261-034	017.261-038	017.261-026	005.281-014	017.261-018	007.281-010	001.261-010	005.281-010
SDII-07	Determining true length with revolution	X	X							X	X	X	X
SDII-08	Drawing intersecting solids	X	X							X	X	X	X
SDII-09	Drawing developments	X	X							X	X		
SDII-10	Measuring distance											X	X
SDII-11	Measuring angles											X	X
SDII-12	Measuring elevations											X	X
SDII-13	Surveying polygonal areas											X	X
Duty III - Technical Science and Strength of Materials													
TSSM-01	Transforming units									X	X	X	X

TASK LISTING BY DOT CODE

Drafting/Design Technology

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME	Drafter, Assistant 017.281-018	Drafter, Apprentice 017.281-014	Drafter, Electrical 003.281-010	Drafter, Electronic 003.281-014	Drafter, Heating and Ventilating 017.261-034	Drafter, Plumbing 017.261-038	Drafter, Commercial 017.261-026	Drafter, Structural 005.281-014	Detailer 017.261-018	Drafter, Mechanical 007.281-010	Drafter, Architectural 001.261-010	Drafter, Civil 005.281-010
TSSM-02	Calculating resultant force									X	X	X	X
TSSM-03	Calculating forces in static system									X	X	X	X
TSSM-04	Calculating stress									X	X	X	X
TSSM-05	Calculating strain									X	X	X	X
TSSM-06	Calculating deformation									X	X	X	X
TSSM-07	Calculating restoring force									X	X	X	X
TSSM-08	Designing area of materials under stress									X	X	X	X
TSSM-09	Calculating frictional forces									X	X	X	X

TASK LISTING BY DOT CODE

Drafting/Design Technology

POSSIBLE EXIT POINTS

	DOT DESCRIPTION	Drafter, Assistant	Drafter, Apprentice	Drafter, Electrical	Drafter, Electronic	Drafter, Heating and Ventilating	Drafter, Plumbing	Drafter, Commercial	Drafter, Structural	Detailer	Drafter, Mechanical	Drafter, Architectural	Drafter, Civil
	DOT NO.	017.281-018	017.281-014	003.281-010	003.281-014	017.261-034	017.261-038	017.261-026	005.281-014	017.261-018	007.281-010	001.261-010	005.281-010
TASK NO.	TASK NAME												
Duty IV - Design Drafting I													
DDI-01	Drawing fasteners	X	X							X	X	X	X
DDI-02	Drawing welds	X	X							X	X	X	X
DDI-03	Dimensioning tolerances	X	X							X	X	X	X
DDI-04	Drawing gears	X	X							X	X	X	X
DDI-05	Drawing cams	X	X							X	X	X	X
DDI-06	Drawing details	X	X							X	X	X	X
DDI-07	Drawing assemblies	X	X							X	X	X	X
DDI-08	Drawing charts	X	X							X	X	X	X

TASK LISTING BY DOT CODE

Drafting/Design Technology

POSSIBLE EXIT POINTS

	DOT DESCRIPTION	Drafter, Assistant	Drafter, Apprentice	Drafter, Electrical	Drafter, Electronic	Drafter, Heating and Ventilating	Drafter, Plumbing	Drafter, Commercial	Drafter, Structural	Detailer	Drafter, Mechanical	Drafter, Architectural	Drafter, Civil
	DOT NO.	017.281-018	017.281-014	003.281-010	003.281-014	017.261-034	017.261-038	017.261-026	005.281-014	017.261-018	007.281-010	001.261-010	005.281-010
TASK NO.	TASK NAME												
DDI-09	Drawing graphs	X	X							X	X	X	X
DDI-10	Sketching designs	X	X							X	X	X	X
DDI-11	Drawing sections	X	X							X	X	X	X
Duty V - Technical Science II													
TSII-01	Calculating mass									X	X	X	X
TSII-02	Describing motion in one dimension									X	X	X	X
TSII-03	Describing motion resulting from forces									X	X	X	X
TSII-04	Describing motion resulting from torques									X	X	X	X
TSII-05	Describing motion using momentum principles									X	X	X	X

II-23

TASK LISTING BY DOT CODE

Drafting/Design Technology

POSSIBLE EXIT POINTS

	DOT DESCRIPTION	Drafter, Assistant	Drafter, Apprentice	Drafter, Electrical	Drafter, Electronic	Drafter, Heating and Ventilating	Drafter, Plumbing	Drafter, Commercial	Drafter, Structural	Detailer	Drafter, Mechanical	Drafter, Architectural	Drafter, Civil
	DOT NO.	017.281-018	017.281-014	003.281-010	003.281-014	017.261-034	017.261-038	017.261-026	005.281-014	017.261-018	007.281-010	001.261-010	005.281-010
TASK NO.	TASK NAME												
TSII-06	Describing motion using energy principles									X	X	X	X
TSII-07	Calculating work									X	X	X	X
TSII-08	Calculating power									X	X	X	X
TSII-09	Calculating efficiency									X	X	X	X
Duty VI - Design Drafting II													
DDII-01	Lettering architecturally		X					X				X	X
DDII-02	Researching and analyzing accepted principles												
	and methods of construction							X				X	

TASK LISTING BY DOT CODE

Drafting/Design Technology

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME	Drafter, Assistant	Drafter, Apprentice	Drafter, Electrical	Drafter, Electronic	Drafter, Heating and Ventilating	Drafter, Plumbing	Drafter, Commercial	Drafter, Structural	Detailer	Drafter, Mechanical	Drafter, Architectural	Drafter, Civil
	DOT NO.	017.281-018	017.281-014	003.281-010	003.281-014	017.261-034	017.261-038	017.261-026	005.281-014	017.261-018	007.281-010	001.261-010	005.281-010
DDII-03	Researching and interpreting the Southern Standard Building Code							X				X	X
DDII-04	Drawing with architectural expression		X					X				X	
DDII-05	Aiding the architect in designing preliminary floor plans							X				X	
DDII-06	Drawing finished floor plans							X				X	
DDII-07	Drawing and reading small commercial survey plats							X				X	X
DDII-08	Drawing a small commercial building foundation plan							X				X	X
DDII-09	Drawing small commercial building elevations							X				X	

TASK LISTING BY DOT CODE

Drafting/Design Technology

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME	DOT NO. 017.281-018 DOT DESCRIPTION Drafter, Assistant	017.281-014 Drafter, Apprentice	003.281-010 Drafter, Electrical	003.281-014 Drafter, Electronic	017.261-034 Drafter, Heating and Ventilating	017.261-038 Drafter, Plumbing	017.261-026 Drafter, Commercial	005.281-014 Drafter, Structural	017.261-018 Detailer	007.281-010 Drafter, Mechanical	001.261-010 Drafter, Architectural	005.281-010 Drafter, Civil
DDII-10	Drawing light commercial building details							X				X	
DDII-11	Aiding the architect in organizing and reproducing specifications for a small commercial building		X					X				X	
Duty VII - Design Drafting III													
DDIII-01	Defining terminology and analyzing theory associated with basic DC circuits			X	X								
DDIII-02	Defining and converting electrical units associated with basic DC and AC circuits			X	X								

TASK LISTING BY DOT CODE

Drafting/Design Technology

POSSIBLE EXIT POINTS

	DOT DESCRIPTION	Drafter, Assistant	Drafter, Apprentice	Drafter, Electrical	Drafter, Electronic	Drafter, Heating and Ventilating	Drafter, Plumbing	Drafter, Commercial	Drafter, Structural	Detailer	Drafter, Mechanical	Drafter, Architectural	Drafter, Civil
	DOT NO.	017.281-018	017.281-014	003.281-010	003.281-014	017.261-034	017.261-038	017.261-026	005.281-014	017.261-018	007.281-010	001.261-010	005.281-010
TASK NO.	TASK NAME												
DDIII-03	Calculating basic DC series circuits			X	X								
DDIII-04	Calculating basic DC parallel circuits			X	X								
DDIII-05	Calculating basic DC series parallel circuits			X	X								
DDIII-06	Defining terminology and analyzing theory associated with basic AC circuits			X	X								
DDIII-07	Calculating power factors, impedance and pure resistance in series AC circuits			X	X								
DDIII-08	Calculating basic AC circuits with inductance reactance and resistance			X	X								
DDIII-09	Calculating basic series AC circuits with capacitive reactance and resistance			X	X								

TASK LISTING BY DOT CODE

Drafting/Design Technology

	POSSIBLE EXIT POINTS DOT DESCRIPTION	Drafter, Assistant	Drafter, Apprentice	Drafter, Electrical	Drafter, Electronic	Drafter, Heating and Ventilating	Drafter, Plumbing	Drafter, Commercial	Drafter, Structural	Detailer	Drafter, Mechanical	Drafter, Architectural	Drafter, Civil
	DOT NO.	017.281-018	017.281-014	003.281-010	003.281-014	017.261-034	017.261-038	017.261-026	005.281-014	017.261-018	007.281-010	001.261-010	005.281-010
TASK NO.	TASK NAME												
DDIII-10	Calculating series AC circuits with capacitive and inductive reactance and resistance			X	X								
DDIII-11	Calculating basic impedance in parallel AC circuits			X	X								
DDIII-12	Applying basic AC circuit theory when drawing residential cable layouts			X									
DDIII-13	Applying basic AC circuit theory when drawing commercial cable layouts			X									
DDIII-14	Drawing electrical one-line diagrams			X									
DDIII-15	Drawing electrical elementary diagrams			X									
DDIII-16	Drawing electronic schematic diagrams				X								

TASK LISTING BY DOT CODE

Drafting/Design Technology

POSSIBLE EXIT POINTS

	DOT DESCRIPTION	Drafter, Assistant	Drafter, Apprentice	Drafter, Electrical	Drafter, Electronic	Drafter, Heating and Ventilating	Drafter, Plumbing	Drafter, Commercial	Drafter, Structural	Detailer	Drafter, Mechanical	Drafter, Architectural	Drafter, Civil
	DOT NO.	017.281-018	017.281-014	003.281-010	003.281-014	017.261-034	017.261-038	017.261-026	005.281-014	017.261-018	007.281-010	001.261-010	005.281-010
TASK NO.	TASK NAME												
DDIII-17	Laying out, taping up and/or drawing basic printed board circuits				X								
Duty VIII - Strength of Materials II													
SMII-01	Calculating centroids of areas								X	X		X	
SMII-02	Calculating moment of inertia of areas								X	X		X	
SMII-03	Calculating shear and moment in simple beams								X	X		X	
SMII-04	Calculating bending and shearing stresses in simple beams								X	X		X	

TASK LISTING BY DOT CODE

Drafting/Design Technology

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME	Drafter, Assistant	Drafter, Apprentice	Drafter, Electrical	Drafter, Electronic	Drafter, Heating and Ventilating	Drafter, Plumbing	Drafter, Commercial	Drafter, Structural	Detailer	Drafter, Mechanical	Drafter, Architectural	Drafter, Civil
	DOT NO.	017.281-018	017.281-014	003.281-010	003.281-014	017.261-034	017.261-038	017.261-026	005.281-014	017.261-018	007.281-010	001.261-010	005.281-010
SMII-05	Designing simple wood or steel beams of standard cross section								X	X		X	
SMII-06	Calculating deflection of simple beams								X	X		X	
SMII-07	Designing structural cross sections for statically indeterminate beams								X	X		X	
SMII-08	Designing structural cross sections for steel and wood columns								X	X		X	
SMII-09	Calculating bending stress with tensile or comprehensive stress in beams and columns								X	X		X	
SMII-10	Calculating torsional stresses in circular shafts								X	X			

TASK LISTING BY DOT CODE

Drafting/Design Technology

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME	Drafter, Assistant	Drafter, Apprentice	Drafter, Electrical	Drafter, Electronic	Drafter, Heating and Ventilating	Drafter, Plumbing	Drafter, Commercial	Drafter, Structural	Detailer	Drafter, Mechanical	Drafter, Architectural	Drafter, Civil
DOT NO.		017.281-018	017.281-014	003.281-010	003.281-014	017.261-034	017.261-038	017.261-026	005.281-014	017.261-018	007.281-010	001.261-010	005.281-010
Duty IX - Design Drafting IV													
DDIV-01	Analyzing the operation of gas and electric hot air heating and electric air cooling systems for residences and small commercial buildings					X		X				X	
DDIV-02	Drawing heating, cooling and ventilating system details					X		X				X	
DDIV-03	Drawing heating, cooling and ventilating duct systems					X		X				X	

TASK LISTING BY DOT CODE

Drafting/Design Technology

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME	Drafter, Assistant	Drafter, Apprentice	Drafter, Electrical	Drafter, Electronic	Drafter, Heating and Ventilating	Drafter, Plumbing	Drafter, Commercial	Drafter, Structural	Detailer	Drafter, Mechanical	Drafter, Architectural	Drafter, Civil
	DOT NO.	017.281-018	017.281-014	003.281-010	003.281-014	017.261-034	017.261-038	017.261-026	005.281-014	017.261-018	007.281-010	001.261-010	005.281-010
DDIV-04	Analyzing plumbing systems for residences and small commercial buildings						X	X					
DDIV-05	Drawing water distribution and sanitary drainage systems for residences					X		X					
DDIV-06	Drawing water distribution and sanitary drainage systems for small commercial buildings						X	X				X	
DDIV-07	Researching data for drawing a process piping working drawing						X						
DDIV-08	Drawing process piping flow diagrams using standard piping and instrumentation symbols						X						

TASK LISTING BY DOT CODE

Drafting/Design Technology

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME	Drafter, Assistant	Drafter, Apprentice	Drafter, Electrical	Drafter, Electronic	Drafter, Heating and Ventilating	Drafter, Plumbing	Drafter, Commercial	Drafter, Structural	Detailer	Drafter, Mechanical	Drafter, Architectural	Drafter, Civil
	DOT NO.	017.281-018	017.281-014	003.281-010	003.281-014	017.261-034	017.261-038	017.261-026	005.281-014	017.261-018	007.281-010	001.261-010	005.281-010
DDIV-09	Drawing isometric process piping systems using standard symbols						X						
DDIV-10	Drawing orthographic process piping drawings using standard symbols						X						
DDIV-11	Describing the production and fabrication of structural steel								X	X			
DDIV-12	Identifying and billing structural steel plain materials								X	X			
DDIV-13	Researching specifications, grades and tolerances for structural steel								X	X			

TASK LISTING BY DOT CODE

Drafting/Design Technology

		POSSIBLE EXIT POINTS											
	DOT DESCRIPTION	Drafter, Assistant	Drafter, Apprentice	Drafter, Electrical	Drafter, Electronic	Drafter, Heating and Ventilating	Drafter, Plumbing	Drafter, Commercial	Drafter, Structural	Detailer	Drafter, Mechanical	Drafter, Architectural	Drafter, Civil
TASK NO.	TASK NAME / DOT NO.	017.281-018	017.281-014	003.281-010	003.281-014	017.261-034	017.261-038	017.261-026	005.281-014	017.261-018	007.281-010	001.261-010	005.281-010
DDIV-14	Researching properties and detailing dimensions for structural steel								X	X			
DDIV-15	Analyzing welding processes and researching welding symbols for structural steel								X	X			
DDIV-16	Aiding the structural engineer in designing and drawing framed and seated beam connections (bolted and riveted)								X	X			
DDIV-17	Aiding the structural engineer in designing and drawing welded framed and seated beam connections								X	X			
DDIV-18	Drawing structural steel column details								X	X			

TASK LISTING BY DOT CODE

Drafting/Design Technology

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME	DOT DESCRIPTION: Drafter, Assistant DOT NO.: 017.281-018	Drafter, Apprentice 017.281-014	Drafter, Electrical 003.281-010	Drafter, Electronic 003.281-014	Drafter, Heating and Ventilating 017.261-034	Drafter, Plumbing 017.261-038	Drafter, Commercial 017.261-026	Drafter, Structural 005.281-014	Detailer 017.261-018	Drafter, Mechanical 007.281-010	Drafter, Architectural 001.261-010	Drafter, Civil 005.281-010
Duty X - Technical Science III													
TSIII-01	Calculating fluid pressure									X	X	X	X
TSIII-02	Calculating fluid velocity									X	X	X	X
TSIII-03	Calculating buoyant force									X	X	X	X
TSIII-04	Describing vibrating systems									X	X	X	X
TSIII-05	Defining the structure of matter									X	X	X	X
TSIII-06	Changing units of temperature									X	X	X	X
TSIII-07	Calculating thermal expansion									X	X	X	X
TSIII-08	Calculating heat transfer									X	X	X	X

TASK LISTING BY DOT CODE

Drafting/Design Technology

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME	Drafter, Assistant	Drafter, Apprentice	Drafter, Electrical	Drafter, Electronic	Drafter, Heating and Ventilating	Drafter, Plumbing	Drafter, Commercial	Drafter, Structural	Detailer	Drafter, Mechanical	Drafter, Architectural	Drafter, Civil
	DOT NO.	017.281-018	017.281-014	003.281-010	003.281-014	017.261-034	017.261-038	017.261-026	005.281-014	017.261-018	007.281-010	001.261-010	005.281-010
TSIII-09	Calculating thermodynamic coordinates of substances									X	X	X	X
TSIII-10	Calculating work done by heat engines									X	X	X	X

SECTION III

UNIT GUIDES

SECTION III

Section III Content List

Unit Guide Description
List of Drafting Tools and Equipment
Suggested Sequence of Unit Guides

In Section II, the relationship between the occupational area and program tasks was introduced. Section III continues this development by presenting, for each task, a unit guide for instructional planning and execution.

The instruction of specific tasks is central to vocational education. However, the value of a single task/competency to the student as a prospective member of the workforce is dependent upon the way in which that task/competency is related to other tasks and to the entire occupational area. Therefore, the Metals Cluster Program Task Listing provides a sample organizational model for sequencing the instruction of program tasks.

UNIT GUIDES DESCRIPTION

In this section the tasks to be taught in each block are presented in sequential order. Each task is listed on a separate page so that it may be taken out of the guide for daily lesson planning or regrouped with other tasks to fit the individual teacher's preference for teaching order. The task pages may be used for planning and executing group instruction or for individualized instruction.

Each page in the UNIT GUIDES section contains the following information:

TASK: This is a short and concise statement of the task to be taught.

PERFORMANCE OBJECTIVE: The performance expected of the student after completing the unit is stated in stem form, without a specific statement of all conditions, equipment and performance standard (these are listed in a criterion referenced measure in the Evaluation section of the task page).

INSTRUCTIONAL ACTIVITIES: Suggested learning activities are presented. These activities include providing information, demonstration, practical applications and projects.

INSTRUCTIONAL MATERIALS: Suggested materials for carrying out the instructional activities are listed. These include textbooks, audiovisuals and equipment. Textbooks are referenced by author and/or title with the complete reference contained in the textbook list in the Instructional Resources section (Appendix A).

EVALUATION: This section contains a criterion referenced measure and reference to any test items or other evaluation measures that are available to teacher.

CLASSROOM HOURS: The ESTIMATED time for completing the instructional activities and the evaluation are provided in the classroom hours section. These suggested hours are the TOTAL instructional time which includes both classroom and laboratory activities. The instructor must use his/her judgment in determining the percentage of total time spent in the classroom and lab.

DRAFTING TOOLS AND EQUIPMENT

Drafting Machine

Parallel Bars

Drawing Board

T-Square

Case Instruments

Ruby Eraser

Mechanical Pencil

Lead Refills
  H, 2H, 4H and 6H

Dusting Brush

Erasing Shield

Lead Pointer

Circle Template

Drafting Aid (do all)

Architect's Scale (12")

Metric Scale

Civil Engineer's Scale (12")

30° x 60° Triangle (8")

45° Triangle (10")

Adjusting Triangle

Lettering Guide

6" Protractor

Irregular Curve

TI 30 Calculator

Drafting Tape

Technical Pens

Pen Points

Drawing Ink (black waterproof)

Pen Wiper

Felt Tip Pens (black, blue, red etc.)

Scissors and Knife

Screwdriver

DRAFTING/DESIGN TECHNOLOGY TASK INDEX

THEORY OF SHAPE DESCRIPTION

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SDI-02 Sketching freehand 15
SDI-03 Analyzing drawings for acceptable drafting practice 17
SDI-04 Drawing plane figures 19
SDI-05 Drawing with line contrast 21
SDI-06 Drawing to scale 23
SDI-07 Drawing in orthographic 25
SDI-08 Dimensioning 27
SDI-09 Drawing in isometric 29

THEORY OF SHAPE DESCRIPTION II

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SDII-02 Drawing fundamental views 33
SDII-03 Connecting skew lines 35
SDII-04 Locating piercing points 37
SDII-05 Drawing plane intersections 39
SDII-06 Determining dihedral angle 41
SDII-07 Determining true length with revolution 43
SDII-08 Drawing intersection solids 45
SDII-09 Drawing developments 47
SDII-10 Measuring distance 49
SDII-11 Measuring angles 51
SDII-12 Measuring elevations 53
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TECHNICAL SCIENCE AND STRENGTH OF MATERIALS

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TSSM-02 Calculating resultant force 59
TSSM-03 Calculating forces in static system 61
TSSM-04 Calculating stress 63
TSSM-05 Calculating strain 65
TSSM-06 Calculating deformation 67
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TSSM-08 Designing area of materials under stress 71
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DESIGN DRAFTING I

DDI-01 Drawing fasteners 75
DDI-02 Drawing welds 77
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TASK

SDI-01 Hand lettering

PERFORMANCE OBJECTIVE

Hand letter in Reinhardt style: titles, notes, list and dimensions.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Lettering styles
b. Lettering strokes
c. Using and drawing guide lines
d. Ames lettering guide
e. Spacing of letters and words
f. Freehand lettering in industry

Provide Demonstration On:

a. Use of Ames lettering guide
b. Strokes in lettering
c. Unacceptable letter forms

Provide Practical Application On:

a. Dimensioning drawings
b. Lettering notes, titles and item lists on drawings

INSTRUCTIONAL MATERIALS

Textbooks:

a. French, Svensen, Helsel and Urbanick, Mechanical Drawing
b. French and Vierck, Engineering Drawing and Graphic Technology
c. Giesecke, et al., Technical Drawing
d. Jensen and Helsel, Fundamentals of Engineering Drawing

A/Vs:

(Continued on back)

Student Manuals:

a. Georgia, Drafting, Basic, Unit 18
b. Gerevas, Drafting Technology Problems

Tools and Equipment:

a. Ames lettering guide or equal
b. 6H and H grades lead pencils

(Continued on back)

LAB HOURS	18
CLASS HOURS	2

EVALUATION (SDI-01)

Using graded lead pencils, an Ames lettering guide or the equivalent, a drafting table with parallel bar, hand lettering notes and a dimensions list, the student will hand letter titles in standard, vertical, uppercase, single-stroke, Reinhardt (or Gothic) style. All letters should be vertical, correctly formed and adequately spaced.

INSTRUCTIONAL MATERIALS

A/Vs:

a. Barr Films, "Lettering," Drafting Series I, filmstrip
b. Georgia, "Using a Lettering Guide," slide/tape; "Using Lettering Devices," slide/tape

Tools and Equipment:

c. Parallel bar
d. Drawing table
e. Drafting vellum
f. Ames lettering guide pamphlet

80

TASK

SDI-02 Sketching freehand

PERFORMANCE OBJECTIVE

Sketch objects freehand in isometric and oblique.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of freehand sketches
b. Using freehand sketching in industry

Provide Demonstration On:

a. Sketching boxes in isometric and oblique
b. Using the box construction method to sketch objects
c. Drawing lines
d. Drawing circles and arcs

Provide Practical Application On:

Sketching objects from life, from drawings and from memory

INSTRUCTIONAL MATERIALS

Textbooks:

a. French, Svensen, Helsel and Urbanick, Mechanical Drawing
b. French and Vierck, Engineering Drawing and Graphic Technology
c. Giesecke, et al., Technical Drawing
d. Jensen and Helsel, Fundamentals of Engineering Drawing

A/Vs:

Georgia, "Perspective Sketching," slide/tape

Student Manuals:

Georgia, Drafting, Basic, Unit 42

Tools and Equipment:

a. Pencil or felt tip pen
b. Paper
c. A hard flat smooth surface

LAB HOURS	18
CLASS HOURS	2

EVALUATION (SDI-02)

Using a pencil or pen and paper, the student will sketch freehand, isometric and oblique objects which contain straight and curved elements. Opposite edges should be parallel and relative dimensions should be proportional so that the sketch renders a true representation of the object.

TASK

SDI-03 Analyzing drawing for acceptable drafting practice

PERFORMANCE OBJECTIVE

Analyze drawings for acceptable drafting practice.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Parameters for grading acceptability of drafting work
b. Parameters for grading sheet

Provide Demonstration On:

Grading drawings using parameters for grading sheet

Provide Practical Application On:

Analyzing drawings for acceptable drafting practice

INSTRUCTIONAL MATERIALS

Textbooks:

a. French, Engineering Drawing
b. French, Svensen, Helsel and Urbanick, Mechanical Drawing
c. Giesecke, et al., Technical Drawing
d. Jensen and Helsel, Fundamentals of Engineering Drawing
e. Spence, Basic Industrial Drafting; Drafting: Technology and Practice

Tools and Equipment:

Various drawings

LAB HOURS	2
CLASS HOURS	2

EVALUATION (SDI-03)

Given various examples of drafting work, the student will analyze assigned drawing(s) using the following 13 parameters for acceptability in industry practices and for identifying areas of strengths and weaknesses.

1. Lettering: Freehand written communication using the proper strokes and style.
2. Line Work: Convention line symbolism. Used consistently throughout drawing.
3. Correctness of Drawing Construction: All items relating to conventional drawing practices and standards.
4. Neatness: Habitually clean and orderly.
5. Clarity of Communication: Can it be built from your drawing?
6. Design: To devise for a specific function or end.
7. Creativity: Having the quality of something created rather than intimidated.
8. Speed: The rate at which a drawing is completed.
9. Correctness of Scale and Dimensioning: (Self Explanatory)
10. Correctness of Symbolism: Do the symbols comply with standards set forth for that specialized field?
11. Correctness of Drawing: Does the drawing supply the necessary graphic information in order that the object can be built?
12. Style of Workmanship: A consistent expression of quality coming from with the individual and displayed on the drawing.
13. Professionalism: The conduct, aims or qualities that characterize or mark a profession or a professional person, including attendance, attitude and personal commitment to the drawing.

TASK

SDI-04 Drawing plane figures

PERFORMANCE OBJECTIVE

Draw regular and irregular plane figures.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Drawing tangents
b. Regular plane figures

Provide Demonstration On:

a. Drawing arcs tangent to arcs and/or lines
b. Drawing parallel lines
c. Dividing plane elements into parts of equal size

Provide Practical Application On:

Drawing plane figures

INSTRUCTIONAL MATERIALS

Textbooks:

a. French, Engineering Drawing
b. French, Svensen, Helsel and Urbanick, Mechanical Drawing
c. Giesecke, et al., Technical Drawing
d. Jensen and Helsel, Fundamentals of Engineering Drawing
e. Spence, Basic Industrial Drafting
f. Spence, Drafting: Technology and Practice

Student Manuals:

Gerevas, Drafting Technology Problems

Tools and Equipment:

a. Drafting tools
b. Pencils
c. Drafting table (or board)
d. Drawing media

LAB HOURS	38
CLASS HOURS	2

EVALUATION (SDI-04)

Given drafting tools and necessary equipment and supplies, the student will draw regular and irregular plane figures with tangents and corners correctly formed and elements the correct size and proportion. The finished drawing must be within the parameters of acceptable drafting practices.

Parameters of Acceptable Drafting Practices

_____ 1. Lettering

_____ 2. Line Work

_____ 3. Correctness of Drawing Construction

_____ 4. Neatness

_____ 5. Clarity of Communication

_____ 6. Design

_____ 7. Creativity

_____ 8. Speed

_____ 9. Correctness of Scale and Dimensioning

_____10. Correctness of Symbolism

_____11. Completeness of Drawing

_____12. Style or Workmanship

_____13. Professionalism

Suggested Grading of Parameters

All items shown above will be rated on a scale of 0-4. All items will be averaged for a total rating. 0=F, 1=D, 2=C, 3=B and 4=A.

TASK

SDI-05 Drawing with line contrast

PERFORMANCE OBJECTIVE

Prepare drawings differentiating line function by contrast of line weights.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. The alphabet of lines
b. Reproducible lines

Provide Demonstration On:

a. Drawing lines of reproducible weights on vellum
b. Rotating pencil for consistency of line weight

INSTRUCTIONAL MATERIALS

Textbooks:

a. French, Engineering Drawing
b. French, Svensen, Helsel and Urbanick, Mechanical Drawing
c. Giesecke, et al., Technical Drawing
d. Jensen and Helsel, Fundamentals of Engineering Drawing
e. Spence, Basic Industrial Drafting; Drafting: Technology and Practice

Tools and Equipment:

Drafting tools

LAB HOURS	1
CLASS HOURS	1

EVALUATION (SDI-05)

Using graded lead and vellum, the student will prepare drawings that are easy to read, that are reproducible and that show contrast between lines according to function.

TASK

SDI-06 Drawing to scale

PERFORMANCE OBJECTIVE

Draw objects to scale.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Architect's scale
b. Engineer's scale
c. Drawing in proportion
d. Metric scales

Provide Demonstration On:

Using architect's scale to measure fractions of a scale inch

Provide Practical Application On:

Drawing to scale

INSTRUCTIONAL MATERIALS

Textbooks:

a. French, Engineering Drawing
b. French, Svensen, Helsel and Urbanick, Mechanical Drawing
c. Giesecke, et al., Technical Drawing
d. Jensen and Helsel, Fundamentals of Engineering Drawing
e. Spence, Basic Industrial Drafting; Drafting: Technology and Practice

Student Manuals:

Gerevas, Drafting Technology Problems

Tools and Equipment:

Drafting tools

LAB HOURS	1
CLASS HOURS	1

EVALUATION (SDI-06)

Given a scale and drafting tools, the student will draw a scale drawing proportional to the true size of the object. All lengths should be correct to ± 1/32 (true size of error). The finished drawing must be prepared within the parameters of acceptable drafting practices.

Parameters of Acceptable Drafting Practices

_____ 1. Lettering

_____ 2. Line Work

_____ 3. Correctness of Drawing Construction

_____ 4. Neatness

_____ 5. Clarity of Communication

_____ 6. Design

_____ 7. Creativity

_____ 8. Speed

_____ 9. Correctness of Scale and Dimensioning

_____10. Correctness of Symbolism

_____11. Completeness of Drawing

_____12. Style or Workmanship

_____13. Professionalism

Suggested Grading of Parameters

All items shown above will be rated on a scale of 0-4. All items will be averaged for a total rating. 0=F, 1=D, 2=C, 3=B and 4=A.

TASK

SDI-07 Drawing in orthographic

PERFORMANCE OBJECTIVE

Making orthographic drawings of objects.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Communicating objects for manufacture
b. First and third angle projection
c. Picture planes

Provide Demonstration On:

Use of miter lines and projection in making drawings

Provide Practical Application On:

Making orthographic drawings of objects

INSTRUCTIONAL MATERIALS

Textbooks:

a. French, Engineering Drawing
b. French, Svensen, Helsel and Urbanick, Mechanical Drawing
c. Giesecke, et al., Technical Drawing
d. Jensen and Helsel, Fundamentals of Engineering Drawing
e. Spence, Basic Industrial Drafting; Drafting: Technology and Practice

Student Manuals:

Gerevas, Drafting Technology Problems

Tools and Equipment:

Drafting tools

LAB HOURS	48
CLASS HOURS	2

EVALUATION (SDI-07)

a. Given basic drafting tools, the student will draw complete objects in orthographic that clearly and accurately communicate the shape of the object for manufacture. The drawing should be within the parameters of acceptable drafting practices.

b. Georgia, Drafting, Basic, Instructor Guide, Unit 23.

Parameters of Acceptable Drafting Practices

_____ 1. Lettering

_____ 2. Line Work

_____ 3. Correctness of Drawing Construction

_____ 4. Neatness

_____ 5. Clarity of Communication

_____ 6. Design

_____ 7. Creativity

_____ 8. Speed

_____ 9. Correctness of Scale and Dimensioning

_____ 10. Correctness of Symbolism

_____ 11. Completeness of Drawing

_____ 12. Style or Workmanship

_____ 13. Professionalism

Suggested Grading of Parameters

All items shown above will be rated on a scale of 0-4. All items will be averaged for a total rating. 0=F, 1=D, 2=C, 3=B and 4=A.

TASK

SDI-08 Dimensioning

PERFORMANCE OBJECTIVE

Dimension drawings of objects.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Dimensioning for clarity
b. Lineweight of extension, dimension lines and center lines
c. Dimensioning systems
    1. Bilateral
    2. Unilateral
d. Use of center lines
e. Double dimensioning

Provide Demonstration On:

a. Making arrowheads
b. Drawing leader lines

Provide Practical Application On:

Dimensioning drawings

INSTRUCTIONAL MATERIALS

Textbooks:

a. French, Engineering Drawings
b. French, Svensen, Helsel and Urbanick, Mechanical Drawing
c. Giesecke, et al., Technical Drawing
d. Jensen and Helsel, Fundamentals of Engineering Drawing
e. Spence, Basic Industrial Drafting; Drafting: Technology and Practice

(Continued on back)

Student Manuals:

Gerevas, Drafting Technology Problems

Tools and Equipment:

Drafting tools

LAB HOURS	29
CLASS HOURS	1

EVALUATION (SDI-08)

Using the unilateral or bilateral system of dimensioning, the student will dimension objects for manufacture without double dimensioning. The completed task must be within the parameters of acceptable drafting practices.

Parameters of Acceptable Drafting Practices

_____ 1. Lettering

_____ 2. Line Work

_____ 3. Correctness of Drawing Construction

_____ 4. Neatness

_____ 5. Clarity of Communication

_____ 6. Design

_____ 7. Creativity

_____ 8. Speed

_____ 9. Correctness of Scale and Dimensioning

_____10. Correctness of Symbolism

_____11. Completeness of Drawing

_____12. Style or Workmanship

_____13. Professionalism

Suggested Grading of Parameters

All items shown above will be rated on a scale of 0-4. All items will be averaged for a total rating. 0=F, 1=D, 2=C, 3=B and 4=A.

INSTRUCTIONAL ACTIVITIES

A/Vs:

Barr Films, "Size Description,"
Drafting Series I, filmstrip

TASK

SDI-09 Drawing in isometric

PERFORMANCE OBJECTIVE

Draw isometric pictorials of objects.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Isometric drawing in industry
b. Isometric axes
c. Angles in isometric
d. Scale and true length in isometric
    1. Box construction method
    2. Skeletal construction method
e. Drawing curves in isomettic

Provide Demonstration On:

Drawing circles in isometric

Provide Practical Application On:

Making isometric drawings of objects

INSTRUCTIONAL MATERIALS

Textbooks:

a. French, *Engineering Drawings*
b. French, Svensen, Helsel and Urbanick, *Mechanical Drawing*
c. Giesecke, et al., *Technical Drawing*
d. Jensen and Helsel, *Fundamentals of Engineering Drawing*
e. Spence, *Basic Industrial Drafting*; *Drafting: Technology and Practice*

(Continued on back)

Student Manuals:

a. Georgia, *Drafting, Basic*, Unit 41
b. Gerevas, *Drafting Technology Problems*

Tools and Equipment:

Drafting tools

LAB HOURS	39
CLASS HOURS	1

EVALUATION (SDI-09)

a. Given drafting tools, the student will make an isometric drawing of an object that correctly communicates its shape. The drawing should be within the parameters of acceptable drafting practices.

b. Georgia, Drafting, Basic, Instructor Guide, Unit 41.

Parameters of Acceptable Drafting Practices

_____ 1. Lettering

_____ 2. Line Work

_____ 3. Correctness of Drawing Construction

_____ 4. Neatness

_____ 5. Clarity of Communication

_____ 6. Design

_____ 7. Creativity

_____ 8. Speed

_____ 9. Correctness of Scale and Dimensioning

_____ 10. Correctness of Symbolism

_____ 11. Completeness of Drawing

_____ 12. Style or Workmanship

_____ 13. Professionalism

Suggested Grading of Parameters

All items shown above will be rated on a scale of 0-4. All items will be averaged for a total rating. 0=F, 1=D, 2=C, 3=B and 4=A.

INSTRUCTIONAL MATERIALS

A/Vs:

a. Barr films, "Isometric Drawing," Drafting Series I, filmstrip

b. Georgia, "Constructing an Isometric Drawing," slide/tape; "Incline and Oblique Lines in Isometric," slide/tape

TASK

SDII-01 Drawing auxiliary views

PERFORMANCE OBJECTIVE

Draw auxiliary and secondary views of objects.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Using auxiliary views in industry
b. Drawing auxiliary views and secondary auxiliary views

Provide Demonstration On:

Using folding plane lines

Provide Practical Application On:

Drawing auxiliary views to clarify the graphical description of objects

INSTRUCTIONAL MATERIALS

Textbooks:

a. Brown, Drafting for Industry
b. French and Vierek, Engineering Drawing and Graphic Technology
c. Giesecke, et al., Technical Drawing
d. Hawk, Descriptive Geometry
e. Hoelscher, Springer and Dobrovolny, Graphics for Engineers
f. Jensen and Helsel, Fundamentals of Engineering Drawing

(Continued on back)

Student Manuals:

a. Georgia, Drafting, Basic Units 201 and 202
b. Hawk, Descriptive Geometry

Tools and Equipment:

a. Drafting tools including dividers
b. Drawing table
c. Parallel bar

LAB HOURS	39
CLASS HOURS	1

EVALUATION (SDII-01)

a. Given basic instruments, the student will use the folding plane method to draw auxiliary and secondary auxiliary views that clarify the description of an object so that it may be manufactured correctly.

b. Georgia, Drafting, Basic, Instructor Guide, Unit 202.

INSTRUCTIONAL MATERIALS

Textbooks:

g. Spence, Basic Industrial Drafting

h. Spence, Drafting: Technology and Practice

A/Vs:

a. Barr Films, "Auxiliary Views," Drafting Series II, filmstrip

b. Georgia, "Primary Auxiliary Views," slide/tape

TASK

SDII-02 Drawing fundamental views

PERFORMANCE OBJECTIVE

Draw the fundamental views of lines and planes.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Use of fundamental views
b. Finding the bearing of a line
c. Use of folding plane lines

Provide Demonstration On:

a. Using dividers to transfer points
b. Finding true length and slope of lines
c. Drawing planes as an edge and in their true size
d. Reading bearings of lines

Provide Practical Application On:

a. Determining the true length, slope and bearing of a line
b. Drawing the true size and shape and finding the true slope of planes

INSTRUCTIONAL MATERIALS

Textbooks:

a. Hoelscher, Springer and Dobrovolny, Graphics for Engineers
b. Luzadder, Fundamentals of Engineering Drawing
c. Hawk, Descriptive Geometry
d. Warner and McNeary, Applied Descriptive Geometry

Student Manuals:

Hawk, Descriptive Geometry

Tools and Equipment:

a. Drafting tools
b. Drawing table
c. Parallel bar

LAB HOURS 24
CLASS HOURS 1

EVALUATION (SDII-02)

Given basic drawing instruments, the student will use descriptive geometry to draw views that show the true length, slope and bearing of lines and views that show the true size, shape and slope of panels. Lengths should be measured correctly to ± 1/32" (full size of error) and angles to ± 30'.

TASK

SDII-03 Connecting skew lines

PERFORMANCE OBJECTIVE

Find the shortest connections or the shortest connection of given slope and bearing between skew lines.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Skew lines and clearances in industry
b. Level line method for showing plane as an edge

Provide Demonstration On:

The plane method of finding connections between skew lines

Provide Practical Application On:

a. Finding the clearance between skew lines
b. Finding the shortest distance of given slope and bearing between skew lines

INSTRUCTIONAL MATERIALS

Textbooks:

a. Hawk, Descriptive Geometry
b. Warner and McNeary, Applied Descriptive Geometry

Student Manuals:

Hawk, Descriptive Geometry

Tools and Equipment:

a. Drafting tools
b. Parallel bar
c. Drawing table

LAB HOURS	14
CLASS HOURS	1

EVALUATION (SDII-03)

Given basic drafting tools, the student will use descriptive geometry to find the clearance between skew lines or the shortest connection of a given slope. Bearing between skew lines should have lengths within ± 1/32" (full size of error) and angles correct to ± 30' accuracy.

TASK

SDII-04 Locating piercing points

PERFORMANCE OBJECTIVE

Locate the point where a plane is pierced by a line.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Piercing points in industry
b. Methods for locating piercing points
    1. Edge view
    2. Two view

Provide Demonstration On:

a. Using the two view method (cutting plane method)
b. Using the edge view method

Provide Practical Application On:

Locating the piercing point

INSTRUCTIONAL MATERIALS

Textbooks:

a. Hawk, Descriptive Geometry
b. Warner and McNeary, Applied Descriptive Geometry

Student Manuals:

Hawk, Descriptive Geometry

Tools and Equipment:

a. Drafting tools
b. Drawing board
c. Parallel bar

LAB HOURS	7
CLASS HOURS	1

EVALUATION (SDII-04)

Given basic drafting instruments, the student will use the edge view or two view method to determine and show the correct visibility of where a line intersects or pierces a plane. Lengths should be within ± 1/32" (full size of error) and angles within ± 30" accuracy.

TASK

SDII-05 Drawing plane intersections

PERFORMANCE OBJECTIVE

Draw the intersection of two planes.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Plane intersections and solid figures
b. Plane intersections in industry
c. Methods for drawing plane intersections
    1. Edge view
    2. Two view

Provide Demonstration On:

a. The two view method
b. The edge view method

Provide Practical Application On:

Drawing the intersection of two planes

INSTRUCTIONAL MATERIALS

Textbooks:

a. Giesecke, et al., Technical Drawing
b. Hawk, Descriptive Geometry
c. Hoelscher, Springer and Dobrovolny, Graphics for Engineers
d. Warner and McNeary, Applied Descriptive Geometry

Student Manuals:

Hawk, Descriptive Geometry

Tools and Equipment:

a. Drafting tools
b. Drawing board
c. Parallel bar

LAB HOURS	10
CLASS HOURS	2

EVALUATION (SDII-05)

Given basic drafting tools, the student will use the two view methods or the edge view method to draw the intersection of two planes into views showing proper third angle visibility. Lengths should be within ± 1/32" (full size of error) and angles within ± 30' accuracy.

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TASK

SDII-06 Determining dihedral angle

PERFORMANCE OBJECTIVE

Determine the dihedral angle between two planes.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Plane intersections and dihedral angles
b. Method for determining the dihedral angle - edge view

Provide Demonstration On:

Plane method of determining the dihedral angle

Provide Practical Application On:

Determining the dihedral angle between two planes

INSTRUCTIONAL MATERIALS

Textbooks:

a. Hawk, Descriptive Geometry
b. Hoelscher, Springer and Dobrovolny, Graphics for Engineers
c. Luzadder, Fundamentals of Engineering Drawing
d. Warner and McNeary, Applied Descriptive Drawing

Student Manuals:

Hawk, Descriptive Geometry

Tools and Equipment:

a. Drafting tools
b. Drawing table
c. Parallel bar

LAB HOURS	7
CLASS HOURS	1

EVALUATION (SDII-06)

Given drafting instruments, the student will use the plane or line method to determine the dihedral angle between two non-parallel planes. The determination must be within ± 30' accuracy.

TASK

SDII-07 Determining true length with revolution

PERFORMANCE OBJECTIVE

Determine the true length of a line by the method of revolution.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Use of revolution in industry to find true lengths
b. The method of revolution

Provide Demonstration On:

Using revolution to find true length

Provide Practical Application On:

Finding the true length of a line using revolution

INSTRUCTIONAL MATERIALS

Textbooks:

a. Giesecke, et al., Technical Drawing
b. Hawk, Descriptive Geometry
c. Hoelscher, Springer and Dobrovolny, Graphics for Engineers
d. Luzadder, Fundamentals of Engineering Drawing
e. Warner and McNeary, Applied Descriptive Geometry

Student Manuals:

Hawk, Descriptive Geometry

Tools and Equipment:

a. Drafting tools
b. Parallel bar
c. Drawing bar

LAB HOURS	7
CLASS HOURS	1

EVALUATION (SDII-07)

Given drafting tools, the student will use the method of revolution to determine the true length of a line from two given views. The determination must be within ± 1/32" accuracy (full size of error).

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TASK

SDII-08 Drawing intersecting solids

PERFORMANCE OBJECTIVE

Draw two views of intersecting solids.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. The occurrence of intersecting solids in industry
b. Methods for drawing intersecting solids
   1. Edge view
   2. Cutting plane

Provide Demonstration On:

Use of cutting plane to draw intersections

Provide Practical Application On:

Drawing intersecting solids

INSTRUCTIONAL MATERIALS

Textbooks:

a. French and Vierck, Engineering Drawing and Graphic Technology
b. Giesecke, et al., Technical Drawing
c. Hawk, Descriptive Geometry
d. Hoelscher, Springer and Dobrovolny, Graphics for Engineers
e. Jensen and Helsel, Fundamentals of Engineering Drawing

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Student Manuals:

Hawk, Descriptive Geometry

Tools and Equipment:

a. Drafting tools
b. Parallel bar
c. Drawing table

LAB HOURS	25
CLASS HOURS	1

EVALUATION (SDII-08)

Given drafting equipment, the student will use the cutting plane or edge view method to show the correct visibility of two intersecting solids in two views.

INSTRUCTIONAL MATERIALS

Textbooks:

f. Luzadder, Fundamentals of Engineering Drawing
g. Spence, Basic Industrial Drafting; Drafting: Technology and Practice
h. Warner and McNeary, Applied Descriptive Geometry

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TASK

SDII-09 Drawing developments

PERFORMANCE OBJECTIVE

Design and draw developments of objects.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

Sheet metal drafting

Provide Demonstration On:

Drawing "stretch outs" or rollouts

Provide Practical Application On:

Drawing developments

INSTRUCTIONAL MATERIALS

Textbooks:

a. Betterley, Sheet Metal Drafting
b. French and Vierch, Engineering Drawing and Graphic Technology
c. Giesecke, et al., Technical Drawing
d. Hawk, Descriptive Geometry
e. Hoelscher, Springer and Dobrovolny, Graphics for Engineers
f. Jensen and Helsel, Fundamentals of Engineering Drawing

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Student Manuals:

a. Georgia, Drafting, Advanced, Unit 5-M
b. Hawk, Descriptive Geometry

Tools and Equipment:

Drafting tools

LAB HOURS	28
CLASS HOURS	2

EVALUATION (SDII-09)

a. Given drafting tools, the student will use the stretchout or tollout method to design and draw developments of objects that can be cut out and folded to correctly form the object.

b. Georgia, Drafting, Advanced, Instructor Guide, Unit 5-M.

INSTRUCTIONAL MATERIALS

Textbooks:

g. Luzadder, Fundamentals of Engineering Drawing
h. Spence, Basic Industrial Drafting; Drafting Technology and Practice

TASK

SDII-10 Measuring distance

PERFORMANCE OBJECTIVE

Measure distances correct to 1 foot in 3000 feet using a steel tape.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. The surveying method
b. Surveying tapes
c. Safe use of steel tape
d. Corrections for scope, temperature and tape length

Provide Demonstration On:

a. Pulling steel tape
b. Pulling distances in a straight line
c. Making tape corrections

Provide Practical Application On:

Measuring distances accurately

INSTRUCTIONAL MATERIALS

Textbooks:

a. Davis and Kelly, *Elementary Plane Surveying*
b. Herubin, *Principles of Surveying*
c. Kissam, *Surveying Practice*

Tools and Equipment:

a. 100 ft. standardized steel tape
b. Chaining pins
c. Pencil
d. Paper

LAB HOURS	3
CLASS HOURS	1

EVALUATION (SDII-10)

Given a 100 foot standardized steel tape, the student will measure a distance, making corrections for slope, temperature and tape length, such that the distance recorded is correct to 1 foot in 3000 feet.

TASK

SDII-11 Measuring angles

PERFORMANCE OBJECTIVE

Measure angles (horizontal and vertical) using a transit.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Care of the transit
b. Reading vernier scales
c. Measuring angles using a transit

Provide Demonstration On:

a. Setting up and leveling the transit over a point
b. Reading vernier scales
c. Turning angles

Provide Practical Application On:

Measuring horizontal and vertical angles using the transit

INSTRUCTIONAL MATERIALS

Textbooks:

a. Davis and Kelly, Elementary Plane Surveying
b. Herubin, Principles of Surveying
c. Kissam, Surveying Practice

Student Manuals:

Georgia, Drafting, Advanced Unit 3-C

Tools and Equipment:

a. Transit
b. Pencil
c. Paper

LAB HOURS	7
CLASS HOURS	1

EVALUATION (SDII-11)

a. Given a transit, the student will measure assigned angles correct to ± 1 minute.

b. Georgia, Drafting, Advanced, Instructor Guide, Unit 3-C.

TASK

SDII-12 Measuring elevations

PERFORMANCE OBJECTIVE

Measure relative elevations using a level and level rod.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Care of level
b. Use of leveling
c. Types of levels
d. Use of benchmarks

Provide Demonstration On:

a. Setting up and leveling a level
b. Using a leveling rod

Provide Practical Application On:

Running levels

INSTRUCTIONAL MATERIALS

Textbooks:

a. Davis and Kelly, Elementary Plane Surveying
b. Herubin, Principles of Surveying
c. Kissam, Surveying Practice

Student Manuals:

Georgia, Drafting, Advanced, Units 7-C and 9-C

Tools and Equipment:

a. Level
b. Level rod
c. Pencil
d. Paper

LAB HOURS	3
CLASS HOURS	1

EVALUATION (SDII-12)

a. Given a level and level rod, the student will measure the relative difference in elevation between two points to ± .01 foot.

b. Georgia, Drafting, Advanced, Instructor Guide, Units 7-C and 8-C.

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TASK

SDII-13 Surveying polygonal areas

PERFORMANCE OBJECTIVE

Survey a closed plane polygonal area.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Use of the loop traverse
b. Computing bearings from given angles
c. Computing angular error
d. Correcting angles
e. Computing and correcting error of closure
f. Computing
    1. Latitudes
    2. Departure
    3. DMD (Double Meridian Distance)
    4. Area

Provide Demonstration On:

Calculating from field data
a. Bearings
b. Angular error
c. Corrected angles
d. Latitudes
e. Departure
f. DMD (Double Meridian Distance)
g. Area
h. Error of closure

Provide Practical Application On:

Surveying plane, closed polygonal areas (the loop traverse)

INSTRUCTIONAL MATERIALS

Textbooks:

a. Davis and Kelly, *Elementary Plane Surveying*
b. Herubin, *Principles of Surveying*
c. Kissam, *Surveying Practice*

A/Vs:

Georgia, "Surveying in Georgia," slide/tape

Student Manuals:

Georgia, *Drafting, Advanced*, Units 1-C and 4-C

Tools and Equipment:

a. Transit with tripod
b. Range poles
c. 100' steel tape
d. Chaining pins
e. Stakes and ax

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LAB HOURS 17

CLASS HOURS 3

EVALUATION (SDII-13)

a. Given surveying equipment and calculator, the student will survey a plane polygonal area, calculating area and error of closure with error of closure less than 1 foot in 3000 feet.

b. Georgia, Drafting, Advanced, Instructor Guide, Units 1-C and 4-C.

INSTRUCTIONAL MATERIALS

Tools and Equipment:

f. Pencil
g. Paper
h. Calculator
i. Trigonometry tables

TASK

TSSM-01 Transforming units

PERFORMANCE OBJECTIVE

Transform (convert) units from one system of measurement to another.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Units of measurement
b. Relationships between systems of measurement

Provide Demonstration On:

Cancellation method of converting units

Provide Practical Application On:

Transforming units

INSTRUCTIONAL MATERIALS

Textbooks:

a. Marcus and Thrower, Introduction to Applied Physics
b. Zebrowski, Physics for the Technician

Tools and Equipment:

a. Calculator
b. Tables of conversion factors

LAB HOURS	3
CLASS HOURS	2

EVALUATION (TSSM-01)

Using a calculator, conversion tables and cancellation methods, the student will transform (convert) units from one system of measurement to another without changing the size of the pnenomenon.

TASK

TSMM-02 Calculating resultant force

PERFORMANCE OBJECTIVE

Calculate the force resulting from the combination of two or more forces.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Force as a vector
b. Force in static and dynamic systems
c. Calculating components of forces

Provide Demonstration On:

a. Using graphical methods for finding resultant force
b. Using component method for calculating the resultant of forces

Provide Practical Application On:

a. Using graphical methods for finding resultant forces
b. Calculating resultant forces

INSTRUCTIONAL MATERIALS

Textbooks:

a. Jensen and Chenoweth, Applied Strength of Materials
b. Levinson, Statics and Strength of Materials
c. Marcus and Thrower, Introduction to Applied Physics
d. Zebrowski, Physics for the Technician

Tools and Equipment:

a. Drafting tools
b. Calculating with trigonometric functions

LAB HOURS	5
CLASS HOURS	3

EVALUATION (TSSM-02)

Using a calculator or drafting equipment, the student will determine the resultant of two or more forces in a plane with magnitude and direction correct within rounding or scale error.

TASK

TSSM-03 Calculating forces in static systems

PERFORMANCE OBJECTIVE

Calculate unknown forces required to keep a static system in a plane in equilibrium.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Forces in equilibrium
b. Static structural systems
c. Torques in equilibrium

Provide Demonstration On:

Calculating forces from static systems using graphical, component parallelagram and torque methods

Provide Practical Application On:

a. Calculating tension or compression in members of structural systems in equilibrium
b. Calculating force required to put systems of forces in equilibrium
c. Calculating forces from torques in equilibrium

INSTRUCTIONAL MATERIALS

Textbooks:

a. Bassin, Brodsky and Wolkoff, Statics and Strength of Materials
b. Jensen and Chenoweth, Applied Strength of Materials
c. Levinson, Statics and Strength of Materials
d. Zebrowski, Physics for the Technician

Tools and Equipment:

a. Calculator
b. Drafting tools

LAB HOURS	7
CLASS HOURS	2

EVALUATION (TSSM-03)

Given a static system of forces in the plane, the student will calculate the direction and magnitude of unknown forces in the system using graphical or mathematical methods with calculations correct within scale or rounding error.

TASK

TSSM-04 Calculating stress

PERFORMANCE OBJECTIVE

Calculate the stress in an elastic element under tension or compression.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Calculating areas
b. Elastic limit of materials
c. Factors of safety
d. Ultimate strength of materials

Provide Demonstration On:

Calculating stress given axile load and cross section

Provide Practical Application On:

a. Calculating stress
b. Checking stress with allowable loads to predict suitability of design

INSTRUCTIONAL MATERIALS

Textbooks:

a. Bruch, Strength of Materials for Technology
b. Jensen and Chenoweth, Applied Strength of Materials
c. Levinson, Statics and Strength of Materials
d. Zebrowski, Physics for the Technician

Tools and Equipment:

Calculator

LAB HOURS	5
CLASS HOURS	1

EVALUATION (TSSM-04)

Given the geometric configuration of an elastic element under axile load, the student will calculate the stress in the element and predict the suitability of the design using calculator and properties of materials tables. Calculation of stress should be correct within rounding error or correct within safe allowable stress of design.

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TASK

TSSM-05 Calculating strain

PERFORMANCE OBJECTIVE

Calculate the strain in an elastic system under tension or compression.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Relationship between stress and strain
b. Keeping units of length and deformation the same
c. Working with small numbers

Provide Demonstration On:

Calculating strain

Provide Practical Application On:

Calculating strain

INSTRUCTIONAL MATERIALS

Textbooks:

a. Bruch, Strength of Materials for Technology
b. Jensen and Chenoweth, Applied Strength of Materials
c. Levinson, Statics and Strength of Materials
d. Zebrowski, Physics for the Technician

Tools and Equipment:

Calculator

LAB HOURS	0
CLASS HOURS	1

EVALUATION (TSSM-05)

Given the deformation and length of an elastic element under axile load, the student will calculate, within rounding error, the strain in the element.

TASK

TSSM-06 Calculating deformation

PERFORMANCE OBJECTIVE

Calculate the deformation of elastic elements under axile loads.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Young's modulus for materials
b. Elastic limit of materials
c. Stress-strain curves

Provide Demonstration On:

Calculating deformation in systems under tension and in systems under compression

Provide Practical Application On:

a. Calculating deformation
b. Designing elements subject to deformation under axile loads

INSTRUCTIONAL MATERIALS

Textbooks:

a. Bruch, Strength of Materials for Technology
b. Jensen and Chenoweth, Applied Strength of Materials
c. Levinson, Statics and Strength of Materials
d. Zebrowski, Physics for the Technician

Tools and Equipment:

Calculator

LAB HOURS	4
CLASS HOURS	1

EVALUATION (TSSM-06)

Using Young's modulus of materials, the student will calculate, within rounding error, the axile deformation of elastic elements under tension or compression.

TASK

TSSM-07 Calculating restoring force

PERFORMANCE OBJECTIVE

Calculate the elastic restoring force in an elastic element under axile stress.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Hooke's law
b. Stiffness of springs

Provide Demonstration On:

a. Forces in springs
b. Stretching elastic materials

Provide Practical Application On:

a. Calculating forces in elastic elements under axile loads
b. Calculating stiffness of springs
c. Calculating change in length of springs under axile loads

INSTRUCTIONAL MATERIALS

Textbooks:

a. Bruch, *Strength of Materials for Technology*
b. Jensen and Chenoweth, *Applied Strength of Materials*
c. Levinson, *Statics and Strength of Materials*
d. Zebrowski, *Physics for the Technician*

Tools and Equipment:

Calculator

LAB HOURS	4
CLASS HOURS	1

EVALUATION (TSSM-07)

Using Hooke's law and the stiffness of an elastic element, the student will calculate, within rounding error, the restoring force of an elastic element deformed by an axile load.

TASK

TSSM-07 Calculating restoring force

PERFORMANCE OBJECTIVE

Calculate the elastic restoring force in an elastic element under axile stress.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Hooke's law
b. Stiffness of springs

Provide Demonstration On:

a. Forces in springs
b. Stretching elastic materials

Provide Practical Application On:

a. Calculating forces in elastic elements under axile loads
b. Calculating stiffness of springs
c. Calculating change in length of springs under axile loads

INSTRUCTIONAL MATERIALS

Textbooks:

a. Bruch, Strength of Materials for Technology
b. Jensen and Chenoweth, Applied Strength of Materials
c. Levinson, Statics and Strength of Materials
d. Zebrowski, Physics for the Technician

Tools and Equipment:

Calculator

LAB HOURS	4
CLASS HOURS	1

EVALUATION (TSSM-07)

Using Hooke's law and the stiffness of an elastic element, the student will calculate, within rounding error, the restoring force of an elastic element deformed by an axile load.

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TASK

TSSM-08 Designing area of materials under stress

PERFORMANCE OBJECTIVE

Design the cross-sectional area of a mechanical or structural element to function under axile loads.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Calculating areas
b. Elastic limit of materials

Provide Demonstration On:

Designing cross sections under axile loads

Provide Practical Application On:

Designing cross sectional areas of structural elements to function under axile loads

INSTRUCTIONAL MATERIALS

Textbooks:

a. Bruch, Strength of Materials for Technology
b. Jensen and Chenoweth, Applied Strength of Materials
c. Levinson, Statics and Strength of Materials
d. Zebrowski, Physics for the Technician

Tools and Equipment:

Calculator

LAB HOURS	5
CLASS HOURS	1

EVALUATION (TSSM-08)

Given properties of materials tables, the student will design the cross-sectional area of a structural element to function under axile loads. The configuration should be calculated within rounding error.

TASK

TSSM-09 Calculating frictional forces

PERFORMANCE OBJECTIVE

Calculate forces on object subject to friction.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Coefficients of static and kinetic friction for various materials
b. Angle of repose
c. Angle of uniform slip

Provide Demonstration On:

a. Angle of repose
b. Angle of uniform slip
c. Static friction
d. Kinetic friction
e. Calculating static and kinetic frictional forces

Provide Practical Application On:

Calculating static and kinetic frictional forces

INSTRUCTIONAL MATERIALS

Textbooks:

a. Marcus and Thrower, *Introduction to Applied Physics*
b. Olivo and Olivo, *Fundamentals of Applied Physics*
c. Pollack, *Applied Physics*
d. Zebrowski, *Physics for the Technician*

Tools and Equipment:

Calculator

LAB HOURS 5
CLASS HOURS 2

EVALUATION (TSSM-09)

Given coefficients of friction tables, the student will calculate static of kinetic frictional forces between objects of various materials. Calculations should be within rounding error.

TASK

DDI-01 Drawing fasteners

PERFORMANCE OBJECTIVE

Draw and specify standard fasteners.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of threads
b. Representations of threads
    1. Detailed
    2. Simplified
    3. Schematic
c. Standard nomenclature for specifying fasteners
d. Standard fasteners
    1. Bolts
    2. Studs
    3. Screws
    4. Keys
    5. Rivets
    6. Washers
    7. Pins
e. Use of fastener tables

Provide Demonstration On:

a. Drawing fasteners
b. Using standard tables

Provide Practical Application On:

Drawing and specifying fasteners (bolts, studs, screws, keys, rivets, pins and washers

INSTRUCTIONAL MATERIALS

Textbooks:

a. Coover and Helsel, Programmed Blueprint Reading
b. French and Vierck, Engineering Drawing and Graphic Technology
c. Giesecke, et al., Technical Drawing
d. Jensen and Helsel, Fundamentals of Engineering Drawing
e. Luzadder, Fundamentals of Engineering Drawing

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Student Manuals:

a. Coover and Helsel, Programmed Blueprint Reading
b. Georgia, Drafting, Advanced, Unit 1-M and 2-M
c. Gerevas, Drafting Technology Problems

Tools and Equipment:

a. Drafting tools
b. Fastener tables

LAB HOURS	11
CLASS HOURS	1

EVALUATION (DDI-01)

a. Given standard tables and using standard nomenclature and graphic representation, the student will correctly draw and specify assigned fasteners.

b. Georgia, Drafting, Advanced, Instructor Guide, Units 1-M and 2-M.

INSTRUCTIONAL MATERIALS

Textbooks:

f. Spence, Basic Industrial Drafting; Drafting: Technology and Practice

A/Vs:

a. Barr Films, "Fasteners," Drafting Series II, filmstrip
b. Georgia, "Drawing Threads," slide/tape

TASK

DDI-02 Drawing welds

PERFORMANCE OBJECTIVE

Draw and specify welds.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Welding processes
b. Welding symbols
c. Types of welds

Provide Demonstration On:

Finding and drawing correct welding symbols

Provide Practical Application On:

Drawing and specifying welding symbols

INSTRUCTIONAL MATERIALS

Textbooks:

a. French, Svensen, Helsel and Urbanick, Mechanical Drawing
b. French and Vierck, Engineering Drawing and Graphic Technology
c. Giesecke, et al., Technical Drawing
d. Jensen and Helsel, Fundamentals of Engineering Drawing
e. Luzadder, Fundamentals of Engineering Drawing
f. Spence, Basic Industrial Drafting; Drafting: Technology and Practice

Student Manuals:

a. Georgia, Drafting, Advanced, Unit 4-M
b. Gerevas, Drafting Technology Problems

Tools and Equipment:

Drafting tools

LAB HOURS	7
CLASS HOURS	1

EVALUATION (DDI-02)

a. Given reference materials and using standard symbols and nomenclature, the student will draw and specify assigned welds. The drawing and specifications must be within the parameters of acceptable drafting practices.

b. Georgia, Drafting, Advanced, Instructor Guide, Unit 4-M.

Parameters of Acceptable Drafting Practices

_____ 1. Lettering

_____ 2. Line Work

_____ 3. Correctness of Drawing Construction

_____ 4. Neatness

_____ 5. Clarity of Communication

_____ 6. Design

_____ 7. Creativity

_____ 8. Speed

_____ 9. Correctness of Scale and Dimensioning

_____10. Correctness of Symbolism

_____11. Completeness of Drawing

_____12. Style or Workmanship

_____13. Professionalism

Suggested Grading of Parameters

All items shown above will be rated on a scale of 0-4. All items will be averaged for a total rating. 0=F, 1=D, 2=C, 3=B and 4=A.

TASK

DDI-03 Dimensioning tolerances

PERFORMANCE OBJECTIVE

Dimension tolerances using standard nomenclature.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of fits
b. Specifications for fits
c. Fit tables
d. Specifying allowances
e. Geometric tolerances and specification symbols
f. Tolerancing for location

Provide Demonstration On:

Use of tolerancing fit tables

Provide Practical Application On:

Specifying tolerances

INSTRUCTIONAL MATERIALS

Textbooks:

a. French, Svensen, Helsel and Urbanick, Mechanical Drawing
b. French and Vierck, Engineering Drawing and Graphic Technology
c. Giesecke, et al., Technical Drawing
d. Jensen and Helsel, Fundamentals of Engineering Drawing
e. Luzadder, Fundamentals of Engineering Drawing
f. Spence, Basic Industrial Drafting; Drafting: Technology and Practice

Student Manuals:

a. Coover and Helsel, Programmed Blueprint Reading
b. Gerevas, Drafting Technology Problems

Tools and Equipment:

Tolerancy fit tables

LAB HOURS 7

CLASS HOURS 1

EVALUATION (DDI-03)

Given rolerancing tables and reference materials, the student will accurately specify assigned tolerances using standard symbols and nomenclature.

TASK

DDI-04 Drawing gears

PERFORMANCE OBJECTIVE

Draw and specify gears using standard symbolism and nomenclature.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of gears
b. Methods for drawing or representing gears
c. Gear formulas

Provide Demonstration On:

a. Drawing involutes
b. Calculating gear data using formulas

Provide Practical Application On:

Drawing gears

INSTRUCTIONAL MATERIALS

Textbooks:

a. French, Svensen, Helsel and Urbanick, Mechanical Drawing
b. French and Vierck, Engineering Drawing and Graphic Technology
c. Giesecke, et al., Technical Drawing
d. Jensen and Helsel, Fundamentals of Engineering Drawing
e. Luzadder, Fundamentals of Engineering Drawing
f. Spence, Basic Industrial Drafting; Drafting: Technology and Practice

Student Manuals:

a. Georgia, Drafting, Advanced, Unit 3-M
b. Gerevas, Drafting Technology Problems

Tools and Equipment:

a. Drafting tools
b. Gear formulas

LAB HOURS	11
CLASS HOURS	1

EVALUATION (DDI-04)

a. Given gear data and formulas, the student will draw and specify gears using standard symbols and nomenclature. The completed task must be within the parameters of acceptable drafting practices.

b. Georgia, Drafting, Advanced, Instructor Guide, Unit 3-M.

Parameters of Acceptable Drafting Practices

_____ 1. Lettering

_____ 2. Line Work

_____ 3. Correctness of Drawing Construction

_____ 4. Neatness

_____ 5. Clarity of Communication

_____ 6. Design

_____ 7. Creativity

_____ 8. Speed

_____ 9. Correctness of Scale and Dimensioning

_____10. Correctness of Symbolism

_____11. Completeness of Drawing

_____12. Style or Workmanship

_____13. Professionalism

Suggested Grading of Parameters

All items shown above will be rated on a scale of 0-4. All items will be averaged for a total rating. 0=F, 1=D, 2=C, 3=B and 4=A.

TASK

DDI-05 Drawing cams

PERFORMANCE OBJECTIVE

Draw plate cam to generate specific follower motion.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Cam motions
    1. Uniform
    2. Modified uniform
    3. Parabolic
    4. Harmonic
    5. Cycloidal
    6. Trapezoid
    7. Modified sine
b. Cam followers

Provide Demonstration On:

a. Drawing and using motion diagrams
b. Using French curve

Provide Practical Application On:

Drawing cams with specified motion and follower

INSTRUCTIONAL MATERIALS

Textbooks:

a. French, Svensen, Helsel and Urbanick, Mechanical Drawing
b. French and Vierck, Engineering Drawing and Graphic Technology
c. Giesecke, et al., Technical Drawing
d. Jensen and Helsel, Fundamentals of Engineering Drawing
e. Luzadder, Fundamentals of Engineering Drawing
f. Spence, Basic Industrial Drafting; Drafting: Technology and Practice

Student Manuals:

a. Georgia, Drafting, Advanced, Unit 3-M
b. Gerevas, Drafting Technology Problems

Tools and Equipment:

Drafting tools

LAB HOURS	11
CLASS HOURS	1

EVALUATION (DDI-05)

a. Given desired follower motion and type, the student will draw a plate cam that will correctly and smoothly generate motion and communicate the cam shape. The work must reflect the parameters of acceptable drafting practices.

b. Georgia, Drafting, Advanced, Instructor Guide, Unit 3-M.

Parameters of Acceptable Drafting Practices

_____ 1. Lettering

_____ 2. Line Work

_____ 3. Correctness of Drawing Construction

_____ 4. Neatness

_____ 5. Clarity of Communication

_____ 6. Design

_____ 7. Creativity

_____ 8. Speed

_____ 9. Correctness of Scale and Dimensioning

_____10. Correctness of Symbolism

_____11. Completeness of Drawing

_____12. Style or Workmanship

_____13. Professionalism

Suggested Grading of Parameters

All items shown above will be rated on a scale of 0-4. All items will be averaged on a total rating. 0=F, 1=D, 2=C, 3=B and 4=A.

TASK

DDI-06 Drawing details

PERFORMANCE OBJECTIVE

Draw details from a working drawing of elements for manufacture.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Use of detail drawings in industry
b. Mark number systems
c. Typical material list

Provide Demonstration On:

a. Drawing details
b. Finding dimensions on working drawings

Provide Practical Application On:

a. Drawing details from assembly and working drawings
b. Finding dimensions on working drawings

INSTRUCTIONAL MATERIALS

Textbooks:

a. French, Svensen, Helsel and Urbanick, Mechanical Drawing
b. French and Vierck, Engineering Drawing and Graphic Technology
c. Giesecke, et al., Technical Drawing
d. Jensen and Helsel, Fundamentals of Engineering Drawing

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Student Manuals:

a. Georgia, Drafting, Basic, Units 51
b. Gerevas, Drafting Technology Problems

Tools and Equipment:

Drafting tools

LAB HOURS	28
CLASS HOURS	2

EVALUATION (DDI-06)

Given working drawings or sketches, the student will accurately draw details of elements for manufacture. The drawings must be within the parameters of acceptable drafting practices.

Parameters of Acceptable Drafting Practices

_____ 1. Lettering

_____ 2. Line Work

_____ 3. Correctness of Drawing Construction

_____ 4. Neatness

_____ 5. Clarity of Communication

_____ 6. Design

_____ 7. Creativity

_____ 8. Speed

_____ 9. Correctness of Scale and Dimensioning

_____ 10. Correctness of Symbolism

_____ 11. Completeness of Drawing

_____ 12. Style or Workmanship

_____ 13. Professionalism

Suggested Grading of Parameters

All items shown above will be rated on a scale of 0-4. All items will be averaged for a total rating. 0=F, 1=D, 2=C, 3=B and 4=A.

INSTRUCTIONAL MATERIALS

Textbooks:

e. Luzadder, Fundamentals of Engineering Drawing
f. Spence, Basic Industrial Drafting; Drafting: Technology and Practice

A/Vs:

a. Barr Films, "Assembly and Detail Drawings," Drafting Series II, filmstrip
b. Georgia, "Working Drawings," slide/tape

TASK

DDI-07 Drawing assemblies

PERFORMANCE OBJECTIVE

Draw assembly drawings of a system with more than one element.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Use of assembly drawings
b. Dimensioning of assembly drawings
c. Types of assembly drawings
   1. Orthographic
   2. Pictorial
   3. Exploded

Provide Practical Application On:

Drawing assembly drawings

INSTRUCTIONAL MATERIALS

Textbooks:

a. French, Svensen, Helsel and Urbanick, Mechanical Drawing
b. French and Vierck, Engineering Drawing and Graphic Technology
c. Giesecke, et al., Technical Drawing
d. Jensen and Helsel, Fundamentals of Engineering Drawing

(Continued on back)

Student Manuals:

a. Georgia, Drafting, Basic, Unit 51
b. Gerevas, Drafting Technology Problems

Tools and Equipment:

Drafting tools

LAB HOURS	38
CLASS HOURS	2

EVALUATION (DDI-07)

Given working drawings or sketches, the student will accurately draw assembly drawings showing relative location of distinct elements making up the assembly. The drawings must be within the parameters of acceptable drafting practices.

Parameters of Acceptable Drafting Practices

_____ 1. Lettering

_____ 2. Line Work

_____ 3. Correctness of Drawing Construction

_____ 4. Neatness

_____ 5. Clarity of Communication

_____ 6. Design

_____ 7. Creativity

_____ 8. Speed

_____ 9. Correctness of Scale and Dimensioning

_____10. Correctness of Symbolism

_____11. Completeness of Drawing

_____12. Style or Workmanship

_____13. Professionalism

Suggested Grading of Parameters

All items shown above will be rated on a scale of 0-4. All items will be averaged for a total rating. 0=F, 1=D, 2=C, 3=B and 4=A.

INSTRUCTIONAL MATERIALS

Textbooks:

e. Luzadder, Fundamentals of Engineering Drawing

f. Spence, Basic Industrial Drafting; Drafting: Technology and Practice

A/Vs:

a. Barr Films, "Assembly and Detail Drawings," filmstrip

b. Georgia, "Working Drawings," slide/tape

TASK

DDI-08 Drawing charts

PERFORMANCE OBJECTIVE

Design and draw charts that clearly communicate relative data.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of charts
b. Use of charts
c. Chart media
d. Mechanically aided lettering
e. Dry transfers

Provide Demonstration On:

Designing a chart

Provide Practical Application On:

Designing and drawing charts

INSTRUCTIONAL MATERIALS

Textbooks:

a. French and Vierck, Engineering Drawing and Graphic Technology
b. Giesecke, et al., Technical Drawing
c. Jensen and Helsel, Fundamentals of Engineering Drawing
d. Luzadder, Fundamentals of Engineering Drawing
e. Spence, Basic Industrial Drafting; Drafting: Technology and Practice

(Continued on back)

Student Manuals:

a. Georgia, Drafting, Basic, Unit 17
b. Gerevas, Drafting Technology Problems

Tools and Equipment:

Drafting tools

LAB HOURS	19
CLASS HOURS	1

EVALUATION (DDI-08)

a. Given a sketch or a list of data, the student will draw charts that clearly communicate the relative size of items. The charts must be within the parameters of acceptable drafting practices.

b. Georgia, Drafting, Basic, Instructor Guide, Unit 17.

Parameters of Acceptable Drafting Practices

_____ 1. Lettering

_____ 2. Line Work

_____ 3. Correctness of Drawing Construction

_____ 4. Neatness

_____ 5. Clarity of Communication

_____ 6. Design

_____ 7. Creativity

_____ 8. Speed

_____ 9. Correctness of Scale and Dimensioning

_____10. Correctness of Symbolism

_____11. Completeness of Drawing

_____12. Style or Workmanship

_____13. Professionalism

Suggested Grading of Parameters

All items shown above will be rated on a scale of 0-4. All items will be averaged for a total rating. 0=F, 1=D, 2=C, 3=B and 4=A.

INSTRUCTIONAL MATERIALS

A/Vs:

Georgia, "Shading and Coloring Techniques," slide/tape

TASK

DDI-09 Drawing graphs

PERFORMANCE OBJECTIVE

Draw graphs of functions which show changing data.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Use of graphs in engineering
b. Conic sections
c. Types of graphs
d. Scale of coordinates

Provide Demonstration On:

Plotting points and connecting them with French curves

Provide Practical Application On:

Drawing graphs

INSTRUCTIONAL MATERIALS

Textbooks:

a. Giesecke, et al., Technical Drawing
b. Luzadder, Fundamentals of Engineering Drawing

Student Manuals:

Georgia, Drafting, Basic, Unit 16

Tools and Equipment:

Drafting tools

LAB HOURS 19
CLASS HOURS 1

EVALUATION (DDI-09)

a. Given a set of ordered pairs of data or a relationship between ordered pairs of data, the student will draw a graph that accurately and clearly shows the relationship for all members of the set within the range of interest. All work must be within the parameters of acceptable drafting practice.

b. Georgia, Drafting, Basic, Instructor Guide, Unit 16.

Parameters of Acceptable Drafting Practice

_____ 1. Lettering

_____ 2. Line Work

_____ 3. Correctness of Drawing Construction

_____ 4. Neatness

_____ 5. Clarity of Communication

_____ 6. Design

_____ 7. Creativity

_____ 8. Speed

_____ 9. Correctness of Scale and Dimensioning

_____10. Correctness of Symbolism

_____11. Completeness of Drawing

_____12. Style or Workmanship

_____13. Professionalism

Suggested Grading of Parameters

All items shown above will be rated on a scale of 0-4. All items will be averaged for a total rating. 0=F, 1=D, 2=C, 3=B and 4=A.

TASK

DDI-10 Sketching diagrams

PERFORMANCE OBJECTIVE

Sketch objects or assemblies to communicate mechanical design concepts.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Use of design sketching in industry
b. Methods of sketching in production

Provide Demonstration On:

Sketching using the box construction method

Provide Practical Application On:

Sketching designs of objects and assemblies

INSTRUCTIONAL MATERIALS

Textbooks:

a. Giesecke, et al., Technical Drawing
b. Jensen and Helsel, Fundamentals of Engineering Drawing
c. Luzadder, Fundamentals of Engineering Drawing

Tools and Equipment:

a. Paper
b. Hard surface
c. Pencil

LAB HOURS	15
CLASS HOURS	1

EVALUATION (DDI-10)

Given a design concept for a mechanical element or system, the student will sketch a freehand graphic representation of a design that clearly shows the design for evaluation of the concept and is within the parameters of acceptable drafting practices.

Parameters of Acceptable Drafting Practices

_____ 1. Lettering

_____ 2. Line Work

_____ 3. Correctness of Drawing Construction

_____ 4. Neatness

_____ 5. Clarity of Communication

_____ 6. Design

_____ 7. Creativity

_____ 8. Speed

_____ 9. Correctness of Scale and Dimensioning

_____10. Correctness of Symbolism

_____11. Completeness of Drawing

_____12. Style or Workmanship

_____13. Professionalism

Suggested Grading of Parameters

All items shown above will be rated on a scale of 0-4. All items will be averaged for a total rating. 0=F, 1=D, 2=C, 3=B and 4=A.

TASK

DDI-11 Drawing sections

PERFORMANCE OBJECTIVE

Draw sections of objects showing interior or obscure detail.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Use of sections in industry
b. Types of sections
c. Material designation
d. Locating section views on drawings
e. Items not cross-hatched
f. Drawing cutting plane lines

Provide Demonstration On:

Drawing cross-hatching

Provide Practical Application On:

Drawing sections to clarify obscure detail

INSTRUCTIONAL MATERIALS

Textbooks:

a. Helsel and Urbanick, Mechanical Drawing
b. French and Vierck, Engineering Drawing and Graphic Technology
c. Giesecke, et al., Technical Drawing
d. Jensen and Helsel, Fundamentals of Engineering Drawing
e. Spence, Basic Industrial Drafting; Drafting: Technology and Practice

(Continued on back)

Student Manuals:

a. Georgia, Drafting, Basic, Units 31, 32, 33 and 34
b. Gerevas, Drafting Technology Problems

Tools and Equipment:

Drafting tools

LAB HOURS	28
CLASS HOURS	2

EVALUATION (DDI-11)

a. Given an orthographic drawing, the student will draw a section view which clearly shows interior detail or cross section obsecured in the drawing. The drawing quality must be within the parameters of acceptable drafting practices.

b. Georgia, Drafting, Basic, Instructor Guide, Units 31 and 34.

Parameters of Acceptable Drafting Practices

_____ 1. Lettering

_____ 2. Line Work

_____ 3. Correctness of Drawing Construction

_____ 4. Neatness

_____ 5. Clarity of Communication

_____ 6. Design

_____ 7. Creativity

_____ 8. Speed

_____ 9. Correctness of Scale and Dimensioning

_____10. Correctness of Symbolism

_____11. Completeness of Drawing

_____12. Style or Workmanship

_____13. Professionalism

Suggested Grading of Parameters

All items shown above will be rated on a scale of 0-4. All items will be averaged for a total rating. 0=F, 1=D, 2=C, 3=B and 4=A.

INSTRUCTIONAL MATERIALS

A/Vs:

a. Barr Films, "Sections," Drafting Series I, filmstrip
b. Georgia, "Sections," slide/ tape

TASK

TSII-01 Calculating mass

PERFORMANCE OBJECTIVE

Calculate the mass of objects from their weight.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Use of mass
b. Units of mass
c. Newton's laws
d. Newton's law of universal gravitation
e. Acceleration due to gravity

Provide Practical Application On:

Calculating mass in the following systems

1. Meters-Kilograms-Second (MKS)
2. Foot-Pound-Seconds (FPS)
3. Centimeter-Gram-Second (CGS)

INSTRUCTIONAL MATERIALS

Textbooks:

a. Harris and Hemmerling, Introductory Applied Physics
b. Marcus and Thrower, Introduction to Applied Physics
c. Pollack, Applied Physics
d. Zebrowski, Physics for the Technician

Tools and Equipment:

Calculator

LAB HOURS	1
CLASS HOURS	1

EVALUATION (TSII-01)

Given the weight of an object, the student will calculate, within rounding error, its mass in the FPS, CGS or MKS systems.

TASK

TSII-02 Describing motion on one dimension

PERFORMANCE OBJECTIVE

Describe the motion of an object experiencing translation of position.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Acceleration
b. Velocity
c. Galileo's technique
d. Falling body formulas

Provide Demonstration On:

a. Finding areas under
   1. Velocity-time
   2. Acceleration-time curves
b. Finding slopes of
   1. Position-time
   2. Velocity-time curves

Provide Practical Application On:

Calculating the parameters of displacement
1. Distance
2. Time
3. Velocity
4. Acceleration

INSTRUCTIONAL MATERIALS

Textbooks:

a. Harris and Hemmerling, Introductory Applied Physics
b. Marcus and Thrower, Introduction to Applied Physics
c. Pollack, Applied Physics
d. Zebrowski, Physics for the Technician

Tools and Equipment:

a. Calculator
b. Drafting equipment

LAB HOURS	5
CLASS HOURS	2

EVALUATION (TSII-02)

Using Galileo's technique or time distance, velocity, acceleration formulas, the student will accurately describe the motion of an object or point experiencing a one dimensional change in position.

TASK

TSII-03 Describing motion resulting from forces

PERFORMANCE OBJECTIVE

Describe motion resulting from the application of one or more forces.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Units of force
b. Newton's laws
c. Formulas describing motion and forces
d. Coefficients of friction of materials

Provide Demonstration On:

a. Angle of repose
b. Angle of uniform slip

Provide Practical Application On:

Calculating a description of motion from forces given

INSTRUCTIONAL MATERIALS

Textbooks:

a. Harris and Hemmerling, Introductory Applied Physics
b. Marcus and Thrower, Introduction to Applied Physics
c. Pollack, Applied Physics
d. Zebrowski, Physics for the Technician

Tools and Equipment:

Calculator

LAB HOURS	5
CLASS HOURS	2

EVALUATION (TSII-03)

Using Newton's laws, the student will correctly describe the motion of an object acted on by one or more forces.

TASK

TSII-04 Describing motion resulting from torques

PERFORMANCE OBJECTIVE

Describe rotational motion resulting from torques.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Calculating moment of inertia
b. Similarities between linear and rotating systems
c. Units for rotational motion

Provide Demonstration On:

Rotational inertia

Provide Practical Application On:

Describing the motion of rotating objects resulting from torques

INSTRUCTIONAL MATERIALS

Textbooks:

a. Harris and Hemmerling, *Introductory Applied Physics*
b. Marcus and Thrower, *Introduction to Applied Physics*
c. Pollack, *Applied Physics*
d. Zebrowski, *Physics for the Technician*

Tools and Equipment:

Calculator

LAB HOURS	5
CLASS HOURS	2

EVALUATION (TSII-04)

Using formulas and torques, the student will calculate, within rounding error, the parameters for describing rotational motion in the required units.

TASK

TSII-05 Describing motion using momentum principles

PERFORMANCE OBJECTIVE

Describe motion of objects using the law of conservation of momentum.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. The law of conservation of momentum
b. Calculating momentum
c. Momentum as a vector

Provide Demonstration On:

The conservation of momentum

Provide Practical Application On:

Describing motion using the law of conservation of momentum

INSTRUCTIONAL MATERIALS

Textbooks:

a. Harris and Hemmerling, *Introductory Applied Physics*
b. Marcus and Thrower, *Introduction to Applied Physics*
c. Pollack, *Applied Physics*
d. Zebrowski, *Physics for the Technician*

Tools and Equipment:

a. Calculator
b. Drafting tools

LAB HOURS	5
CLASS HOURS	2

EVALUATION (TSII-05)

Using the law of conservation of momentum, the student will numerically or graphically describe, within scale or rounding error, the motion (velocity and direction) of a two body event.

TASK

TSII-06 Describing motion using energy principles

PERFORMANCE OBJECTIVE

Use conservation of energy to describe the motion of objects.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Calculating
   1. Kinetic energy
   2. Potential energy
b. The relationship between kinetic and potential energy
c. Nonconservative systems

Provide Demonstration On:

Falling bodies

Provide Practical Application On:

Describing the motion of objects or systems using conservation of energy principles

INSTRUCTIONAL MATERIALS

Textbooks:

a. Harris and Hemmerling, Introductory Applied Physics
b. Marcus and Thrower, Introduction to Applied Physics
c. Pollack, Applied Physics
d. Zebrowski, Physics for the Technician

Tools and Equipment:

Calculator

LAB HOURS	5
CLASS HOURS	2

EVALUATION (TSII-06)

Using the conservation of energy principle, the student will numerically describe the motion of an object or system acted on by conservative forces.

TASK

TSII-07 Calculating work

PERFORMANCE OBJECTIVE

Calculate work as a function of force and distance or change in energy.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. The relationship between work and change in energy
b. Work as the area under a force-distance curve
c. The units of work

Provide Demonstration On:

Calculating work mathematically and graphically

Provide Practical Application On:

Calculating work

INSTRUCTIONAL MATERIALS

Textbooks:

a. Harris and Hemmerling, Introductory Applied Physics
b. Marcus and Thrower, Introduction to Applied Physics
c. Pollack, Applied Physics
d. Zebrowski, Physics for the Technician

Tools and Equipment:

a. Calculator
b. Drafting equipment

LAB HOURS 5
CLASS HOURS 2

EVALUATION (TSII-07)

Using change in energy or the area under a force-distance curve, the student will calculate, within rounding error, the work done by a force in a mechanical system in the proper units.

TASK

TSII-08 Calculating power

PERFORMANCE OBJECTIVE

Calculate power as a function of work.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

Units of power

Provide Demonstration On:

Calculating power

Provide Practical Application On:

Calculating power

INSTRUCTIONAL MATERIALS

Textbooks:

a. Harris and Hemmerling, *Introductory Applied Physics*
b. Marcus and Thrower, *Introduction to Applied Physics*
c. Pollack, *Applied Physics*
d. Zebrowski, *Physics for the Technician*

Tools and Equipment:

Calculator

LAB HOURS	4
CLASS HOURS	2

EVALUATION (TSII-08)

Using work time, the student will calculate power in the proper units. The calculation should be numerically correct within rounding error.

TASK

TSII-09 Calculating efficiency

PERFORMANCE OBJECTIVE

Calculate the efficiency of a nonconservative mechanical system.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Indicated horsepower
b. Friction horsepower
c. Brake horsepower

Provide Demonstration On:

Calculating efficiency

Provide Practical Application On:

a. Calculating efficiency
b. Calculating power requirements as a function of work time and efficiency

INSTRUCTIONAL MATERIALS

Textbooks:

a. Harris and Hemmerling, Introductory Applied Physics
b. Marcus and Thrower, Introduction to Applied Physics
c. Pollack, Applied Physics
d. Zebrowski, Physics for the Technician

Tools and Equipment:

Calculator

LAB HOURS 1
CLASS HOURS 1

EVALUATION (TSII-09)

Using work input and output or power input and output, the student will calculate, within rounding error, the efficiency of a mechanical system.

TASK

DDII-01 Lettering architecturally

PERFORMANCE OBJECTIVE

Hand letter in an architectural style acceptable to the architectural engineering profession.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Lettering styles
    1. Condensed
    2. Extended
    3. Variation
    4. Kabel modern
    5. Inclined
    6. Chisel
    7. Triangle
b. Title blocks, sheets layouts and schedules

Provide Demonstration On:

Techniques of lettering on vellum, film and linen with plastic lead, graphite lead and ink

Provide Practical Application On:

a. Sheet layouts, title blocks and schedules for commercial building
b. Lettering on vellum and plastic film showing selected styles and guide lines for copying these styles

INSTRUCTIONAL MATERIALS

Textbooks:

a. Goodban and Hayslett, Architectural Drawing and Planning
b. Muller, Architectural Drawing and Light Construction

Tools and Equipment:

a. Drafting tools
b. One pack of E1 plastic lead
c. One pack of E3 plastic lead
d. One pack of E5 plastic lead

LAB HOURS	8
CLASS HOURS	2

EVALUATION (DDII-01)

NOTE: From a number of examples of architectural lettering styles provided by the instructor, the student should select a style most suitable to him or her. Once this style has been selected, all others should be omitted.

Using a leadholder, with graphite or plastic lead, or a technical pen and ink and a selected architectural lettering style acceptable to the architectural engineering profession, the student will complete an assigned lettering exercise that includes letters and numbers with guidelines of various heights. This exercise should be done in the selected style from memory in 15 minutes or less. The instructor will evaluate the exercise on line neatness, style emulation, speed, workmanship and professionalism. The student is expected to obtain a grade of "B" or better.

TASK

DDII-02 Researching and analyzing accepted principles and methods of construction

PERFORMANCE OBJECTIVE

Research and analyze accepted principles and methods of construction for residences and small commercial buildings.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Construction terminology
b. Footing and foundations
c. Wood frame construction and materials
d. Plank-and-beam frame construction
e. Brick and stone veneer construction
f. Solid masonry and cavity wall construction
g. Roof types and coverings
h. Exterior finish materials
i. Interior finishes and trim
j. Insulation, vapor barriers and ventilation
k. Modular component construction
l. Vendor materials

Provide Demonstration On:

Construction methods and principles common to student's geographic area

Provide Practical Application On:

Information items through the use of local field trips

INSTRUCTIONAL MATERIALS

Textbooks:

a. Ching, *Building Construction Illustrated*
b. Goodban and Hayslett, *Architectural Drawing and Planning*
c. Hornbostel, *Construction Materials: Types, Uses and Applications*
d. Muller, *Architectural Drawing and Light Construction*
e. Putnam and Carlson, *Architectural Building Trades Dictionary*

(Continued on back)

Tools and Equipment:

a. Drafting tools
b. No print grid isometric drafting pad

LAB HOURS 15
CLASS HOURS 5

EVALUATION (DDII-02)

Using finished reference information and given a design problem, the student will research and analyze possible solutions, then sketch these solutions on an isometric drafting pad to communicate the possible solutions. The student is expected to solve the design problem with a grade of "B" or better.

INSTRUCTIONAL MATERIALS

Textbooks:

f. Ramsey and Sleeper, Archi-Graphic Standards
g. Schmidt, Olin and Lewis, Construction Principles, Materials and Methods
h. Smith, Principles and Practices of Light Construction
i. Spence, Architecture: Design, Engineering, Drawing

A/Vs:

Casettes Unlimited, "The World of the Construction Site: Residential Architecture," filmstrip; "The World of the Construction Site: Commercial Architecture," filmstrip

TASK

DDII-03 Researching and interpreting the Southern Standard Building Code

PERFORMANCE OBJECTIVE

Research and interpret the Southern Standard Building Code for minimum requirements for residential and small commercial buildings.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. The purpose of the code
b. How the code is organized
c. Extracting information from the code
d. Keep the code up to date

Provide Demonstration On:

Case histories showing results of code violations

Provide Practical Application On:

a. Commercial building design project
b. Existing blueprints and specifications problem handout sheets

INSTRUCTIONAL MATERIALS

Textbooks:

Southern Building Code Congress, Inc., The Standard Building Code

Tools and Equipment:

a. Paper
b. Pencil

LAB HOURS	0
CLASS HOURS	10

EVALUATION (DDII-03)

Given the Southern Standard Building Code and adequate time, the student will research and interpret instructor developed questions concerning minimum requirements as they apply to residential and small commercial buildings. The student is expected to research and interpret all items with a minimum accuracy of 90%.

TASK

DDII-04 Drawing with architectural expression

PERFORMANCE OBJECTIVE

Draw in architectural style using techniques, symbolism and conventions accepted by the architectural engineering profession.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Line weight and contrast
b. Dimensioning techniques
c. Notes on drawings
d. Abbreviations on drawings
e. Material symbols
f. Use of architectural templates
g. Use of schedules
h. Pencil, plastic lead and inking techniques
i. Principles of modular drafting
j. Metric system of dimensioning
k. Drawing reproduction
l. Drawing papers and films

Provide Demonstration On:

a. Information items using overhead projector
b. Print machine using papers and sepias

Provide Practical Application On:

a. Commercial building designs
b. Existing working drawings
c. Problem handout sheets on information items

INSTRUCTIONAL MATERIALS

Textbooks:

a. Goodban and Hayslett, *Architectural Drawing and Planning*
b. Muller, *Architectural Drawing and Light Construction*
c. Putnam and Carlson, *Architectural and Building Trades Dictionary*
d. Spence, *Architecture: Design, Engineering, Drawing*

Tools and Equipment:

a. Drafting tools
b. Printer machine

LAB HOURS 13
CLASS HOURS 2

EVALUATION (DDII-04)

Given architectural drawing problems, the student will draw the assigned drawings in an architectural style using techniques, symbolism and conventions acceptable to the architectural engineering profession. The student is expected to score a minimum of a "B" on all items within the parameters of acceptable drafting practices.

Parameters of Acceptable Drafting Practices

_____ 1. Lettering

_____ 2. Line Work

_____ 3. Correctness of Drawing Construction

_____ 4. Neatness

_____ 5. Clarity of Communication

_____ 6. Design

_____ 7. Creativity

_____ 8. Speed

_____ 9. Correctness of Scale and Dimensioning

_____10. Correctness of Symbolism

_____11. Completeness of Drawing

_____12. Style or Workmanship

_____13. Professionalism

Suggested Grading of Parameters

All items shown above will be rated on a scale of 0-4. All items will be averaged for a total rating. 0=F, 1=D, 2=C, 3=B and 4=A.

TASK

DDII-05 Aiding the architect in designing preliminary floor plans

PERFORMANCE OBJECTIVE

Aid the architect in designing a small commercial building preliminary floor plan.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Code restriction and zoning
b. Site planning
c. Traffic flow
d. Floor space requirements
e. Merchandising areas
f. Areas for comfort of employees and/or customers
g. Working areas (manufacturing, shipping and receiving
h. Storage areas
i. Outdoor areas (parking and access)
j. Noise control
k. Future expansion
l. Utilities (lighting, electrical HVAC, plumbing)
m. Stairs, elevators, ramps
n. Checklist

Provide Demonstration On:

a. "Baloon" sketching (rough sketching for floor plans due to importance and location)
b. Sketching on grid sheets
c. Using checklist

Provide Practical Application On:

a. Existing floor plans
b. Existing preliminaries (available from architects)

INSTRUCTIONAL MATERIALS

Textbooks:

a. Frishman, Loshak and Strelka, *Metric Architectural Drawing*
b. Goodban and Hayslett, *Architectural Drawing and Planning*
c. Hornbostel, *Construction Materials: Types, Uses and Applications*
d. Muller, *Architectural Drawing and Light Construction*

Tools and Equipment:

a. Drafting tools
b. Vellum

LAB HOURS	18
CLASS HOURS	2

EVALUATION (DDII-05)

Given a floor plan and existing preliminaries, the student will show his/her ability to aid an architect by designing a small commercial building floor plan that would be acceptable to the engineering architectural profession. The student is expected to score a minimum of a "B" on all items within the parameters of acceptable drafting practices.

Parameters of Acceptable Drafting Practices

_____ 1. Lettering

_____ 2. Line Work

_____ 3. Correctness of Drawing Construction

_____ 4. Neatness

_____ 5. Clarity of Communication

_____ 6. Design

_____ 7. Creativity

_____ 8. Speed

_____ 9. Correctness of Scale and Dimensioning

_____ 10. Correctness of Symbolism

_____ 11. Completeness of Drawing

_____ 12. Style or Workmanship

_____ 13. Professionalism

Suggested Grading of Parameters

All items shown above will be rated on a scale of 0-4. All items will be averaged for a total rating. 0=F, 1=D, 2=C, 3=B and 4=A.

TASK

DDII-06 Drawing finished floor plans

PERFORMANCE OBJECTIVE

Draw a finished floor plan for a small commercial building from sketches or preliminary floor plans.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Standard scales for floor plans
b. Dimensioning procedures
c. Sheet format and title block
d. Sheet numbering system
e. Reference symbols
f. Notes, schedules and engineering information included on floor plan
g. Grid lines for columns (if needed)
h. Lettering style and format
i. Architectural floor plan templates
j. Reproduction
k. Review of architectural expression

Provide Demonstration On:

a. Dimensioning procedures
b. Sheet numbering systems
c. Grid lines for columns

Provide Practical Application On:

Existing floor plans (show comparison between good and poor plans)

INSTRUCTIONAL MATERIALS

Textbooks:

a. Frishman, Loshak and Strelka, Metric Architectural Drawing
b. Goodban and Hayslett, Architectural Drawing and Planning
c. Hornbostel, Construction Materials: Types, Uses and Applications
d. Muller, Architectural Drawing and Light Construction
e. Spence, Architecture: Design, Engineering, Drawing

(Continued on back)

Student Manuals:

Georgia, Drafting, Advanced, Unit 2-A

Tools and Equipment:

Drafting tools

LAB HOURS 18
CLASS HOURS 2

EVALUATION (DDII-06)

a. Given a design sketch, the student will draw a finished floor plan that would be acceptable to the architectural engineering profession. The student is expected to score a minimum of a "B" on all items within the parameters of acceptable drafting practices.

b. Georgia, Drafting, Advanced, Instructor Guide, Unit 2-A.

Parameters of Acceptable Drafting Practices

_____ 1. Lettering
_____ 2. Line Work
_____ 3. Correctness of Drawing Construction
_____ 4. Neatness
_____ 5. Clarity of Communication
_____ 6. Design
_____ 7. Creativity
_____ 8. Speed
_____ 9. Correctness of Scale and Dimensioning
_____10. Correctness of Symbolism
_____11. Completeness of Drawing
_____12. Style or Workmanship
_____13. Professionalism

Suggested Grading of Parameters

All items shown above will be rated on a scale of 0-4. All items will be averaged for a total rating. 0=F, 1=D, 2=C, 3=B and 4=A.

INSTRUCTIONAL MATERIALS

A/Vs:

Georgia, "Drawing a Floor Plan," slide/tape

TASK

DDII-07 Drawing and reading small commercial survey plats

PERFORMANCE OBJECTIVE

Draw and read small commercial surveying plats showing standard symbols and conventions.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Interpolating new and existing contours
b. Standard symbols and conventions
c. Legal description of surveys
d. Recording and researching surveys
e. Inking on vellum, films and linen
f. Mechanically aided lettering techniques
g. Calculating
    1. Bearings
    2. Taping
    3. Measuring angles

Provide Demonstration On:

The chalkboard and/or the overhead projector on information items

Provide Practical Application On:

a. Grided evaluation marks used to establish contours
b. Field party notes showing property lines and location of existing topographical features, changes and additions to the topography
c. Hypothetical surveys to meet design criteria for small commercial buildings

INSTRUCTIONAL MATERIALS

Textbooks:

a. Davis, Foote and Kelly, Surveying: Theory and Practice
b. Herubin, Principles of Surveying
c. Kissam, Surveying Practice

A/Vs:

Georgia, "Surveying in Georgia," slide/tape

Student Manuals:

Georgia, Drafting, Advanced, Units 1-C through 8-C

Tools and Equipment:

a. Drafting tools
b. Flexible curve
c. Mechanically aided lettering device

LAB HOURS	23
CLASS HOURS	2

EVALUATION (DDII-07)

a. Given two surveying plats and reference materials, the student will score at least 75% on a written exam covering items found on the survey, problem areas of surveys and frequently used symbols and conventions.

b. Given professional plats, reference information and a list of required items to be included in the surveying plat, the student will draw two small commercial surveying plats showing standard symbols and conventions that would be acceptable to the surveying field. The student is expected to score a minimum of a "B" on all items within the parameters of acceptable drafting practices.

c. Georgia, Drafting, Advanced, Instructor Guide, Unit 1-C.

Parameters of Acceptable Drafting Practices

_____ 1. Lettering

_____ 2. Line Work

_____ 3. Correctness of Drawing Construction

_____ 4. Neatness

_____ 5. Clarity of Communication

_____ 6. Design

_____ 7. Creativity

_____ 8. Speed

_____ 9. Correctness of Scale and Dimensioning

_____ 10. Correctness of Symbolism

_____ 11. Completeness of Drawing

_____ 12. Style or Workmanship

_____ 13. Professionalism

Suggested Grading of Parameters

All items shown above will be rated on a scale of 0-4. All items will be averaged for a total rating. 0=F, 1=D, 2=C, 3=B and 4=A.

TASK

DDII-08 Drawing a small commercial building foundation plan

PERFORMANCE OBJECTIVE

Draw a small commercial building foundation plan from engineering sketches and preliminary floor plans.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Scales for foundation plans
b. Dimensioning procedures
c. Reference symbols
d. Standard foundation details
e. Code requirements
f. Lettering style and format
g. Plans of existing similar foundations
h. Vendor materials
i. Review of light construction principles for foundation
j. Review of architectural expression
k. Surveying plat with existing contours, utility lines entries and exits

Provide Demonstration On:

Using the floor plan for a starting point for the foundation plan using a print and overlays

Provide Practical Application On:

Existing foundation plans similar to the one being drawn

INSTRUCTIONAL MATERIALS

Textbooks:

a. Ambrose, Simplified Design of Building Structures
b. Frishman, Loshak and Strelka, Metric Architectural Drawing and Planning
c. Goodban and Hayslett, Architectural Drawing and Planning
d. Hornbostel, Construction Materials: Types, Uses and Applications

(Continued on back)

Student Manuals:

Georgia, Drafting, Advanced, Unit 3-A

Tools and Equipment:

Drafting tools

LAB HOURS 23

CLASS HOURS 2

EVALUATION (DDII-08)

a. Given engineering sketches and preliminary floor plans, the student will draw a small commercial building foundation plan that would be acceptable to the architectural engineering profession. The student is expected to score a minimum of a "B" on all items within the parameters of acceptable drafting practices.

b. Georgia, Drafting, Advanced, Instructor Guide, Unit 3-A.

Parameters of Acceptable Drafting Practices

_____ 1. Lettering

_____ 2. Line Work

_____ 3. Correctness of Drawing Construction

_____ 4. Neatness

_____ 5. Clarity of Communication

_____ 6. Design

_____ 7. Creativity

_____ 8. Speed

_____ 9. Correctness of Scale and Dimensioning

_____ 10. Correctness of Symbolism

_____ 11. Completeness of Drawing

_____ 12. Style or Workmanship

_____ 13. Professionalism

Suggested Grading of Parameters

All items shown above will be rated on a scale of 0-4. All items will be averaged for a total rating. 0=F, 1=D, 2=C, 3=B and 4=A.

Task DDII-08

INSTRUCTIONAL MATERIALS

Textbooks:

e. Muller, Architectural Drawing and Light Construction
f. Spence, Architecture: Design, Engineering, Drawing

A/Vs:

Georgia, "Drawing a Foundation Plan," slide/tape

TASK

DDII-09 Drawing small commercial building elevations

PERFORMANCE OBJECTIVE

Draw small commercial building elevations from engineering sketches and preliminary elevations.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Scales for elevations
b. Dimensioning procedures
c. Exterior material symbols
d. Lettering style and format
e. Elevations of existing similar buildings
f. Review of light construction principles
g. Review of architectural expression
h. Foundation plan for the design
i. Plot plan for the design
j. Vendor materials

Provide Demonstration On:

Using the floor plan for constructing elevations

Provide Practical Application On:

Existing elevations on small commercial buildings

INSTRUCTIONAL MATERIALS

Textbooks:

a. Goodban and Hayslett, Architectural Drawing and Planning
b. Muller, Architectural Drawing and Light Construction
c. Spence, Architecture: Design, Engineering, Drawing

A/Vs:

Georgia, "How to Draw Elevations," slide/tape

Student Manuals:

Georgia, Drafting, Advanced, Unit 5-A

Tools and Equipment:

Drafting tools

LAB HOURS	23
CLASS HOURS	2

EVALUATION (DDII-09)

a. Given engineering sketches and preliminary elevations, the student will draw small commercial elevations that would be acceptable to the architectural engineering profession. The student is expected to score a minimum of a "B" on all items within the parameters of acceptable drafting practices.

b. Georgia, Drafting, Advanced, Instructor Guide, Unit 5-A.

Parameters of Acceptable Drafting Practices

_____ 1. Lettering

_____ 2. Line Work

_____ 3. Correctness of Drawing Construction

_____ 4. Neatness

_____ 5. Clarity of Communication

_____ 6. Design

_____ 7. Creativity

_____ 8. Speed

_____ 9. Correctness of Scale and Dimensioning

_____10. Correctness of Symbolism

_____11. Completeness of Drawing

_____12. Style or Workmanship

_____13. Professionalism

Suggested Grading of Parameters

All items shown above will be rated on a scale of 0-4. All items will be averaged for a total rating. 0=F, 1=D, 2=C, 3=B and 4=A.

TASK

DDII-10 Drawing light commercial building details

PERFORMANCE OBJECTIVE

Draw light commercial building details.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Wall sections
b. Window details
c. Door details
d. Wood framing details
e. Stair details
f. Mill work details
g. Bar joist details
h. Laminated beam and column details
i. Review of architectural expression
j. Other miscellaneous details (as required for commercial building)

Provide Demonstration On:

Techniques of detailing showing relative importance of lines and material symbols

Provide Practical Application On:

a. Existing architectural details showing arrangement, scales and reference symbols
b. Small commercial building design

INSTRUCTIONAL MATERIALS

Textbooks:

a. Frishman, Loshak and Strelka, Metric Architectural Drawing and Planning
b. Goodban and Hayslett, Architectural Drawing and Planning
c. Hornbostel, Construction Materials: Types, Uses and Applications
d. Muller, Architectural Drawing and Light Construction
e. Spence, Architecture: Design, Engineering, Drawing

Student Manuals:

Georgia, Drafting, Advanced, Unit 4-A

Tools and Equipment:

Drafting tools

LAB HOURS	23
CLASS HOURS	2

EVALUATION (DDII-10)

a. Given assignments, the student will draw light commercial building details showing arrangement, scales and reference symbols that would be acceptable to the architectural engineering profession. The student is expected to score a minimum of a "B" on all items within the parameters of acceptable drafting practices.

b. Georgia, Drafting, Advanced, Instructor Guide, Unit 4-A.

Parameters of Acceptable Drafting Practices

_____ 1. Lettering

_____ 2. Line Work

_____ 3. Correctness of Drawing Construction

_____ 4. Neatness

_____ 5. Clarity of Communication

_____ 6. Design

_____ 7. Creativity

_____ 8. Speed

_____ 9. Correctness of Scale and Dimensioning

_____ 10. Correctness of Symbolism

_____ 11. Completeness of Drawing

_____ 12. Style or Workmanship

_____ 13. Professionalism

Suggested Grading of Parameters

All items shown above will be rated on a scale of 0-4. All items will be averaged for a total rating. 0=F, 1=D, 2=C, 3=B and 4=A.

TASK

DDII-11 Aiding the architect in organizing and reproducing specifications for a small commercial building

PERFORMANCE OBJECTIVE

Aid the architect in organizing and reproducing specifications for a small commercial building.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. City and national codes and ordinances
b. Testing societies (A.S.T.M. and A.S.A.)
c. Government agencies
    1. GHA, NHA
    2. Government printing office
d. Manufacturer's catalogs
e. Model specifications
f. Previously written specifications
g. Federal specifications (general service administration)
h. Construction Specifications Institute

(Continued on back)

Provide Demonstration On:

a. Purpose of specifications
b. Formats and techniques
c. Research from manufacturer's catalogs
d. Offset and photocolor machine

Provide Practical Application On:

Previously written specifications

INSTRUCTIONAL MATERIALS

Textbooks:

a. American Institute of Timber Construction, *Timber Construction Manual*
b. Ching, *Building Construction Illustrated*
c. Goodban and Hayslett, *Architectural Drawing and Planning*
d. Hornbostel, *Construction Materials: Types, Uses and Applications*
e. Miller, *Architectural Drawing and Light Construction*

(Continued on back)

Tools and Equipment:

Drafting tools

LAB HOURS 0

CLASS HOURS 13

EVALUATION (DDII-11)

Given an assignment, the student will show his/her ability to aid the architect in organizing and reproducing specifications for a small commercial building. These specifications must be in a format that would be acceptable to the architectural engineering profession.

INSTRUCTIONAL MATERIALS

Textbooks:

f. National Association of Women in Construction, Construction Dictionary
g. Rathbun, Building Construction Specifications
h. Schmidt, Olin and Lewis, Construction Principles, Materials and Methods
i. Smith, Principles and Practices of Light Construction
j. Spence, Architecture: Design, Engineering, Drawing
k. Watson, Specifications Writing for Architects and Engineers

TASK

DDIII-01 Defining terminology and analyzing theory associated with basic D.C. circuits

PERFORMANCE OBJECTIVE

Define terminology and analyze theory associated with basic D.C. circuits.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Atom
b. Molecule
c. Nucleus
d. Neutron
e. Proton
f. Electron
g. Free electron
h. Conductor
i. Insulator
j. Electron theory
k. Sources of electron movement
l. Coulomb
m. Amphere
n. Joule
o. EMF (electromotive force)-voltage
p. Power

(Continued on back)

Provide Demonstration On:

a. Electron theory
b. Sources of electron movement
c. Static electricity versus current electricity
d. Other information items as needed for terminology explanation

Provide Practical Application On:

Observing low voltage D.C. circuits as needed to facilitate terminology explanations

INSTRUCTIONAL MATERIALS

Textbooks:

a. Snow, Electrical Drafting and Design
b. Zbar, Basic Electricity
c. Zebrowski, Physics for the Technician

A/Vs:

a. Audio Active, Inc., "Basic Electricity Program," cassette tape

(Continued on back)

Student Manuals:

Zbar, Basic Electricity

Tools and Equipment:

Pencil and loose leaf binder

LAB HOURS 0
CLASS HOURS 10

EVALUATION (DDIII-01)

Given a prescribed terminology list and questions concerning D.C. theory, the student will define the terms and answer the questions with a minimum accuracy of 80%.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

q. Work
r. Watt
s. Ohm
t. Voltage drop
u. Series circuit
v. Parallel circuit
w. Magnetomotive force
x. Flux
y. Permeability
z. Reluctance
aa. Current
bb. Resistance

INSTRUCTIONAL MATERIALS

A/Vs:

b. Bergwall Productions, Inc., "Basic Electricity and Electronics: Direct Current," filmstrip

TASK

DDIII-02 Defining and converting electrical units associated with basic D.C. and A.C. circuits

PERFORMANCE OBJECTIVE

Define and convert electrical units associated with basic D.C. and A.C. circuits.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

Converting from base units in ohms, volts, amperes, watts, hertz, farads, henries, meters and coulombs to metric conversion units of

a. Micro
b. Milli
c. Kilo
d. Mega
e. Giga
f. Nano
g. Pico
h. Deci
i. Cent

Provide Demonstration On:

Unit conversions

Provide Practical Application On:

Observing A.C. and D.C. circuits

INSTRUCTIONAL MATERIALS

Textbooks:

a. Grob, Basic Electronics
b. Shrader, Electronic Communication
c. Tandy Corp., Electronics Data Book

A/Vs:

Audio Active, Inc., "Basic Electricity Program," cassette tape

Tools and Equipment:

a. Pencil and loose leaf binder
b. Electronic calculator with trig functions

LAB HOURS	0
CLASS HOURS	10

EVALUATION (DDIII-02)

Given a list of electrical units, electrical unit conversion problems, electronic calculator and necessary time, the student will define the units and convert them with an accuracy of 80%.

TASK

DDIII-03 Calculating basic D.C. series circuits

PERFORMANCE OBJECTIVE

Calculate basic D.C. series circuits.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Electron theory
b. Current flow
c. Coulomb
d. Joule
e. EMF (voltage)
f. Watts (power)
g. Resistance
h. Conductors
i. Ammeter
j. Voltmeter
k. Ohm's law
l. Schematic diagram
m. Kirchoff' laws
n. Voltage drop
o. Resistors in series

(Continued on back)

Provide Demonstration On:

All information items using overhead, filmstrip projectors and chalkboard

Provide Practical Application On:

a. Series circuits wiring mock-ups illustrating all information items
b. Sample series circuits on handout sheets finding voltage, resistance, current and power

INSTRUCTIONAL MATERIALS

Textbooks:

a. Shrader, Electronic Communication
b. Snow, Electrical Drafting and Design
c. Zbar, Basic Electricity

A/Vs:

a. Audio Active, "Basic Electricity Program," cassette tape

(Continued on back)

Student Manuals:

ESP, Inc., Basic Electricity Program

Tools and Equipment:

a. Pencil and loose leaf binder
b. Calculator with trig functions

LAB HOURS	0
CLASS HOURS	10

EVALUATION (DDIII-03)

Given basic series D.C. circuit problems, an electronic calculator and necessary time, the student will calculate these problems with a minimum accuracy of 85%.

INSTRUCTIONAL ACTIVITIES	INSTRUCTIONAL MATERIALS
Provide Information On:	A/Vs:
p. Sources of EMF q. Insulators r. Schematic symbols s. Ohmmeter t. Safety	b. Bergwall Productions, Inc., "Basic Electricity and Electronics: Direct Current," filmstrip c. Creative Visuals, "Basic Electricity," transparencies

TASK

DDIII-04 Calculating basic D.C. parallel circuits

PERFORMANCE OBJECTIVE

Calculate basic D.C. parallel series circuits.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Ohm's law
b. Review of formula conversion
c. Joule
d. Coulomb
e. Current
f. Voltage
g. Resistance
h. Power
i. Fuses
j. Kirchoff's laws
k. Voltage drop
l. Conductance
m. Resistors in parallel
n. Schematic symbols
o. Ammeter
p. Voltmeter
q. Ohmmeter
r. Safety

Provide Demonstration On:

All information items using overhead and filmstrip projectors and chalkboard

Provide Practical Application On:

a. Parallel circuits wiring mock-ups illustrating all information items
b. Sample parallel circuits on handout sheets finding voltage, resistance, current and power

INSTRUCTIONAL MATERIALS

Textbooks:

a. Grob, Basic Electronics
b. Shrader, Electronic Communication
c. Zbar, Basic Electricity

A/Vs:

a. Audio Active, "Basic Electricity Program," cassette tape
b. Bergwall Productions, Inc., "Basic Electricity and Electronics: Direct Current," filmstrip

Student Manuals:

a. ESP, Inc., Basic Electricity Program
b. Zbar, Basic Electricity

Tools and Equipment:

a. Pencil and loose leaf notebook
b. Calculator with trig functions

LAB HOURS	0
CLASS HOURS	10

EVALUATION (DDIII-04)

Given basic parallel D.C. circuit problems, an electronic calculator and necessary time, the student will calculate these problems with a minimum accuracy of 85%.

TASK

DDIII-05 Calculating basic D.C. series parallel circuits

PERFORMANCE OBJECTIVE

Calculate basic D.C. series circuits.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Ohm's law
b. Review of formula conversion
c. Current
d. Voltage
e. Resistance
f. Power
g. Kirchoff's law
h. Voltage drops
i. Conductance
j. Resistors in series
k. Resistors in parallel
l. Schematic symbols
m. Ammeters
n. Voltmeters
o. Ohmmeters
p. Safety

Provide Demonstration On:

All information items using overhead and filmstrip projectors and the chalkboard

Provide Practical Application On:

a. Series - parallel circuits, wiring mock-ups illustrating all information items
b. Sample series - parallel circuits on handout sheets finding voltage, resistance, current and power

INSTRUCTIONAL MATERIALS

Textbooks:

a. Grob, *Basic Electronics*
b. Shrader, *Electronic Communication*
c. Zebrowski, *Physics for the Technician*

A/Vs:

a. Audio Active, "Basic Electricity Program," cassette tape
b. Bergwall Productions, Inc., "Basic Electricity and Electronics: Direct Current," filmstrip

Student Manuals:

a. ESP, Inc., *Basic Electricity Program*
b. Zbar, *Basic Electricity*

Tools and Equipment:

a. Pencil and loose leaf notebook
b. Electronic calculator with trig functions

LAB HOURS	0
CLASS HOURS	10

EVALUATION (DDIII-05)

Given basic series-parallel circuit problems, an electronic calculator and necessary time, the student will calculate these problems with a minimum accuracy of 85%.

TASK

DDIII-06 Defining terminology and analyzing theory associated with basic A.C. circuits

PERFORMANCE OBJECTIVE

Define terminology and analyze theory associated with basic A.C. circuits.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Alternators
b. Sinusoidal waves
c. Alternations
d. Magnitude vectors
e. Instantaneous values
f. RMS values
g. Average values
h. Hertz
i. Amplitude
j. Phase angle
k. Peak value
l. Effective value
m. Radians
n. Power factor
o. Watts
p. Inductance

(Continued on back)

Provide Demonstration On:

Information items using the overhead and filmstrip projectors and chalkboard

Provide Practical Application On:

Low voltage A.C. circuits as needed to facilitate terminology explanations

INSTRUCTIONAL MATERIALS

Textbooks:

a. Grob, *Basic Electronics*
b. Shrader, *Electronic Communication*
c. Zebrowski, *Physics for the Technician*

A/Vs:

a. Audio Active, "Basic Electricity Program," cassette tape
b. Bergwall Productions, Inc., "Basic Electricity and Electronics: Alternating Current," filmstrip

Tools and Equipment:

Pencil and loose leaf binder

LAB HOURS	0
CLASS HOURS	10

EVALUATION (DDIII-06)

Given a list of terminology items and questions associated with basic A.C. circuits, the student will define the terminology and answer questions with a minimum accuracy of 85%.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

q. Impedance
r. Apparent and true power
s. Capacitance
t. Inductance reactance
u. Capacitive reactance
v. Conductance
w. Susceptance
x. Admittance
y. Transformer theory

TASK

DDIII-07 Calculating power factors, impedance and pure resistance in series A.C. circuits

PERFORMANCE OBJECTIVE

Calculate power factors, impedance and pure resistance in series A.C. circuits.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Inductance
b. Inductance reactance
c. Capacitance and capacitance reactance
d. Impedance
e. Formulas for a-d above
f. Phase angles
g. D.C. and A.C. wave forms
h. Peak, effective and average values of A.C.
i. Ohm's law
j. Formulas for power and power factors
k. Schematic symbols
l. Frequency
m. Apparent and true power
n. Safety
o. Graphic solutions for circuit problems

Provide Demonstration On:

All information items using overhead and filmstrip projectors and chalkboard

Provide Practical Application On:

a. Circuits involving power factors, impedance and pure resistance in series circuits mock-ups
b. Sample circuits (handout sheets) power factors, impedance and pure resistance

INSTRUCTIONAL MATERIALS

Textbooks:

a. Grob, Basic Electronics
b. Shrader, Electronic Communication

A/Vs:

a. Audio Active, "Basic Electricity Program," cassette tape
b. Bergwall Productions, Inc., "Basic Electricity and Electronics: Alternating Current," filmstrip

Student Manuals:

ESP, Inc., Basic Electricity Program

Tools and Equipment:

a. Pencil and loose leaf binder
b. Electronic calculator with trig functions

LAB HOURS	0
CLASS HOURS	10

EVALUATION (DDIII-07)

Given basic problems involving power factors, impedance and pure resistance in series A.C. circuits and an electronic calculator, the student will calculate these problems with a minimum accuracy of 85%.

TASK

DDIII-08 Calculating basic series A.C. circuits with inductance reactance and resistance

PERFORMANCE OBJECTIVE

Calculate basic series A.C. circuits with inductance reactance and resistance.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Inductance and inductive reactance
b. Impedance
c. Formulas for items a and b
d. Phase angles
e. Frequency
f. Schematic symbols
g. Power and power factor formulas
h. Graphic solutions for circuit problems

Provide Demonstration On:

All information items using overhead and filmstrip projectors and chalkboard

Provide Practical Application On:

a. Series circuits involving inductive reactance and circuit mock-ups
b. Sample circuit handout sheets finding inductive reactance, voltage, current, impedance, resistance and phase angles in LR series A.C. circuits

INSTRUCTIONAL MATERIALS

Textbooks:

a. Grob, Basic Electronics
b. Shrader, Electronic Communication
c. Zbar, Basic Electricity

A/Vs:

a. Audio Active, "Basic Electricity Program," cassette tape
b. Bergwall Productions, Inc., "Basic Electricity and Electronics: Alternating Current," filmstrip

Student Manuals:

ESP, Inc., Basic Electricity Program

Tools and Equipment:

a. Pencil and loose leaf notebook
b. Electronic calculator with trig functions

LAB HOURS	0
CLASS HOURS	10

EVALUATION (DDIII-08)

Given basic problems involving series A.C. circuits with inductance reactance and resistance and an electronic calculator, the student will calculate these with a minimum accuracy of 85%.

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TASK

DDIII-09 Calculating basic series A.C. circuits with capacitive reactance and resistance

PERFORMANCE OBJECTIVE

Calculate basic series A.C. circuits with capacitive reactance and resistance.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Capacitance and capacitive reactance
b. Impedance
c. Formulas for items a and b
d. Phase angles
e. Frequency
f. Schematic symbols
g. Power and power factor formulas
h. Graphic solution for circuit problems

Provide Demonstration On:

All information items using overhead and filmstrip projectors and chalkboard

Provide Practical Application On:

a. Series circuits involving capacitive reactance and resistance in circuit mock-ups
b. Sample circuit handout sheets finding capacitive reactance, voltage, current, impedance, resistance and phase angles in RC series A.C. circuits

INSTRUCTIONAL MATERIALS

Textbooks:

a. Grob, Basic Electronics
b. Shrader, Electronic Communication
c. Zbar, Basic Electricity

A/Vs:

a. Audio Active, "Basic Electricity Program," cassette tape
b. Bergwall Productions, Inc., "Basic Electricity and Electronics: Alternating Current," filmstrip

Student Manuals:

ESP, Inc., Basic Electricity Program

Tools and Equipment:

a. Pencil and loose leaf notebook
b. Electronic calculator with trig functions

LAB HOURS 0
CLASS HOURS 10

EVALUATION (DDIII-09)

Given basic problems involving series A.C. circuits with capacitance reactance and resistance and an electronic calculator, the student will calculate these with a minimum accuracy of 85%.

TASK

DDIII-10 Calculating series A.C. circuits with capacitive and inductive reactance and resistance

PERFORMANCE OBJECTIVE

Calculate series A.C. circuits with capacitive and inductive reactance and resistance.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Capacitance and capacitive reactance
b. Inductance and inductive reactance
c. Impedance
d. Formulas for items a-c
e. Phase angles
f. Frequency calculations
g. Schematic symbols
h. Power and power factor formulas
i. Graphic solution for circuit problems
j. Current and voltage calculations

Provide Demonstration On:

All information items using overhead and filmstrip projectors and chalkboard

Provide Practical Application On:

a. Series circuits involving inductive and capacitive reactance and resistance in circuit mock-ups
b. Sample circuit handout sheets finding capacitive reactance, inductive reactance, voltage, current, impedance, resistance and phase angles in RC series A.C. circuits

INSTRUCTIONAL MATERIALS

Textbooks:

a. Grob, Basic Electronics
b. Shrader, Electronic Communication
c. Zbar, Basic Electricity

A/Vs:

a. Audio Active, "Basic Electricity Program," cassette tape
b. Bergwall Productions, Inc., "Basic Electricity and Electronics: Alternating Current," filmstrip

Student Manuals:

ESP, Inc., Basic Electricity Program

Tools and Equipment:

a. Pencil and loose leaf notebook
b. Electronic calculator with trig functions

LAB HOURS	0
CLASS HOURS	10

EVALUATION (DDIII-10)

Given basic problems involving A.C. circuits with capacitive and inductive reactance and resistance and an electronic calculator, the student will calculate these with a minimum accuracy of 85%.

TASK

DDIII-11 Calculating basic impedance in parallel A.C. circuits

PERFORMANCE OBJECTIVE

Calculate basic impedance in parallel A.C. circuits.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Capacitance and capacitive reactance
b. Inductance and inductive reactance
c. Impedance
d. Formulas for items a-c
e. Phase angles
f. Frequency
g. Schematic symbols
h. Graphic solutions for circuits
i. Voltage and current calculations
j. Safety

Provide Demonstration On:

All information items using overhead and filmstrip projectors and chalkboard

Provide Practical Application On:

a. Parallel circuits involving impedance in A.C. parallel circuit mock-ups
b. Sample circuit handout sheets finding impedance, current and voltage in basic parallel A.C. circuits

INSTRUCTIONAL MATERIALS

Textbooks:

a. Grob, Basic Electronics
b. Shrader, Electronic Communication
c. Zbar, Basic Electricity

A/Vs:

a. Audio Active, "Basic Electricity Program," cassette tape
b. Bergwall Productions, Inc., "Basic Electricity and Electronics: Alternating Current," filmstrip

Student Manuals:

ESP, Inc., Basic Electricity Program

Tools and Equipment:

a. Pencil and loose leaf notebook
b. Electronic calculator with trig functions

LAB HOURS 0

CLASS HOURS 10

EVALUATION (DDIII-11)

Given basic problems involving A.C. circuits with impedance and an electronic calculator, the student will calculate these with a minimum accuracy of 85%.

TASK

DDIII-12 Applying basic A.C. circuit theory when drawing residential cable layouts

PERFORMANCE OBJECTIVE

Apply basic A.C. circuit theory when drawing residential cable layouts from engineering sketches.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Electrical code
b. Symbols and outlets
c. Circuits required
d. Conductor sizes and types
e. Lighting circuits
f. Special purpose outlets
g. TV, telephone and signal systems
h. Electric heating
i. Gas or oil heating
j. Service entrance calculations
k. Service entrances and equipment
l. Remote control lodging
m. Electrical standards
n. Existing residential cable layouts

Provide Demonstration On:

Circuit wiring using the overhead and filmstrip projectors and chalkboard

Provide Practical Application On:

a. Existing residential electrical systems
b. Classroom mock-up wiring circuits

INSTRUCTIONAL MATERIALS

Textbooks:

a. Croft, American Electricians' Handbook
b. Mullin, Electrical Wiring -Residential
c. Snow, Electrical Drafting and Design

A/Vs:

a. Bergwall Productions, Inc.," Electrical House Wiring Explained," filmstrip

(Continued on back)

Student Manuals:

Georgia, Drafting, Advanced-Unit 7-A

Tools and Equipment:

a. Drafting tools
b. Electrical symbols template

LAB HOURS 25
CLASS HOURS 5

EVALUATION (DDIII-12)

a. Given a residential floor plan, necessary electrical references, design sketches and drafting supplies, the student will apply basic A.C. circuit theory when drawing residential cable layouts. The student must score a "B" or better on all items within the parameters of acceptable drafting practices.

b. Georgia, Drafting, Advanced, Instructor's Guide, Unit 7-A.

Parameters of Acceptable Drafting Practices

_____1. Lettering

_____2. Line Work

_____3. Correctness of Drawing Construction

_____4. Neatness

_____5. Clarity of Communication

_____6. Design

_____7. Creativity

_____8. Speed

_____9. Correctness of Scale and Dimensioning

____10. Correctness of Symbolism

____11. Completeness of Drawing

____12. Style of Workmanship

____13. Professionalism

Suggested Grading of Parameters

All items shown above will be rated on a scale of 0-4. All items will be averaged for a total rating. 0=F, 1-D, 2=C, 3=B and 4=A.

INSTRUCTIONAL MATERIALS

A/Vs:

b. Bergwall Productions, Inc., "Residential Electrical Wiring-Planning and Roughing In," filmstrip
c. Bergwall Productions, Inc., "Residential Electrical Wiring-Finishing the Installation," filmstrip
d. Bergwall Productions, Inc., "Residential Electrical Wiring-Low Voltage and Special Circuits," filmstrip
e. DCA Educational Products, "Electrical Wiring-Residential," transparencies

TASK

DDIII-13 Applying basic A.C. circuit theory when drawing commercial cable layouts

PERFORMANCE OBJECTIVE

Apply basic A.C. circuit theory when drawing commercial cable layouts from engineering sketches.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Commercial building plans and specifications
b. Electrical service
c. Branch circuit requirements
d. Low-voltage remote lighting
e. Switch control of ligting circuits
f. Appliance of circuits
g. Heating and cooling systems
h. Special circuits
i. Over current protection
j. Drawing panelboards and schedules
k. Lighting layouts
l. National Electrical Code

Provide Demonstration On:

Circuit wiring using the overhead and filmstrip projectors and chalkboard

Provide Practical Application On:

a. Existing residential electrical systems
b. Classroom mock-up wiring circuits

INSTRUCTIONAL MATERIALS

Textboooks:

a. Croft, American Electricians' Handbook
b. Mullin and Smith, Electrical Wiring-Commercial

Tools and Equipment:

Drafting tools

LAB HOURS	30
CLASS HOURS	5

EVALUATION (DDIII-13)

Given a commercial floor plan, necessary electrical references, necessary design sketches and drafting supplies and equipment, the student will apply basic A.C. circuit theory when drawing commercial cable layouts. The student must score a "B" or better on all items within the parameters of acceptable drafting practices.

Parameters of Acceptable Drafting Practices

_____1. Lettering
_____2. Line Work
_____3. Correctness of Drawing Construction
_____4. Neatness
_____5. Clarity of Communication
_____6. Design
_____7. Creativity
_____8. Speed
_____9. Correctness of Scale and Dimensioning
____10. Correctness of Symbolism
____11. Completeness of Drawing
____12. Style of Workmanship
____13. Professionalism

Suggested Grading of Parameters

All items shown above will be rated on a scale of 0-4. All items will be averaged for a total rating. 0=F, 1=d, 2=C, 3=B and 4=A.

TASK

DDIII-14 Drawing electrical one-line diagrams

PERFORMANCE OBJECTIVE

Draw electrical one-line diagrams from engineering sketches.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Definition and purpose
b. System selection
    1. Radial system
    2. Primary selective system
    3. Secondary selective system
    4. Primary selective, secondary network system
c. Information sources
d. Power transformer
e. Circuit breakers
f. Fuses
g. Connected loads
h. Metering devices

(Continued on back)

Provide Demonstration On:

Techniques for layout and drawing one-line diagrams

Provide Practical Application On:

Existing one-line diagrams showing information items

INSTRUCTIONAL MATERIALS

Textbooks:

Snow, Electrical Drafting and Design

Tools and Equipment:

Drafting tools

LAB HOURS	13
CLASS HOURS	2

EVALUATION (DDIII-14)

Given an engineering sketch of a one-line diagram, necessary symbol references and drafting supplies and equipment, the student will draw a one-line diagram. The student must score a "B" or better on all items within the parameters of acceptable drafting practices.

Parameters of Acceptable Drafting Practices

_____1. Lettering

_____2. Line Work

_____3. Correctness of Drawing Construction

_____4. Neatness

_____5. Clarity of Communication

_____6. Design

_____7. Creativity

_____8. Speed

_____9. Correctness of Scale and Dimensioning

____10. Correctness of Symbolism

____11. Completeness of Drawing

____12. Style or Workmanship

____13. Professionalism

Suggested Grading of Parameters

All items shown above will be rated on a scale of 0-4. All items will be averaged for a total rating. 0=F, 1=D, 2=C, 3=B and 4=A.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

i. Miscellaneous devices
j. One-line diagram examples
k. Symbol standards
l. Checklist

TASK

DDIII-15 Drawing electrical elementary diagrams

PERFORMANCE OBJECTIVE

Draw electrical elementary diagrams from engineering sketches.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Definition and purpose
b. Symbols
c. Relays
d. Solenoids
e. Mechanically operated switches
f. Selector switches
g. Overload relays for motor starters
h. Control power source
i. Steps in developing an elementary diagram
j. Manual motor control
k. Motor starting with start-stop pushbutton stations
l. Two wire control circuits

(Continued on back)

Provide Demonstration On:

Techniques for laying out and drawing elementary diagrams

Provide Practical Application On:

Existing elementary diagrams showing information items

INSTRUCTIONAL MATERIALS

Textbooks:

Snow, Electrical Drafting and Design

Tools and Equipment:

Drafting tools

LAB HOURS 13
CLASS HOURS 2

EVALUATION (DDIII-15)

Given an engineering sketch of an electrical elementary diagram, necessary symbol references and drafting supplies and equipment, the student will draw an electrical elementary diagram. The student must score a "B" or better on all items within the parameters of acceptable drafting practices.

Parameters of Acceptable Drafting Practices

_____1. Lettering

_____2. Line Work

_____3. Correctness of Drawing Construction

_____4. Neatness

_____5. Clarity of Communication

_____6. Design

_____7. Creativity

_____8. Speed

_____9. Correctness of Scale and Dimensioning

____10. Correctness of Symbolism

____11. Completeness of Drawing

____12. Style or Workmanship

____13. Professionalism

Suggested Grading of Parameters

All items shown above will be rated on a scale of 0-4. All items will be averaged for a total rating. 0=F, 1=D, 2=C, 3=B and 4=A.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

m. Sequence control
n. Wire numbers on elementary diagrams
o. Wire requirements
o. Layout and drawing techniques

TASK

DDIII-16 Drawing electronic schematic diagrams

PERFORMANCE OBJECTIVE

Draw electronic schematic diagrams from engineering sketches.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Definition and purpose
b. Composition of diagrams
    1. Symbols and arrangement
    2. Signal and power flow
    3. Component identification
    4. Operating controls
c. Stage layouts
d. Switch circuitry
e. Logic diagrams
f. Filter and tuned circuits
g. Geometric systems layout
h. Simplified layouts
i. Relay circuits

(Continued on back)

Provide Demonstration On:

Techniques for laying out and drawing schematic diagrams

Provide Practical Application On:

Good and poor arrangements of schematic diagrams

INSTRUCTIONAL MATERIALS

Textbooks:

a. Raskhodoff, Electronic Drafting and Design
b. Stiers, Electronic Drafting

Tools and Equipment:

a. Drafting tools
b. Electronics schematic template

LAB HOURS	13
CLASS HOURS	2

EVALUATION (DDIII-16)

Given an engineering sketch of an electronic schematic diagram, necessary symbol references and drafting supplies and equipment, the student will draw an electronic schematic diagram. The student must score a "B" or better on all items within the parameters of acceptable drafting practices.

Parameters of Acceptable Drafting Practices

______1. Lettering

______2. Line Work

______3. Correctness of Drawing Construction

______4. Neatness

______5. Clarity of Communication

______6. Design

______7. Creativity

______8. Speed

______9. Correctness of Scale and Dimensioning

____10. Correctness of Symbolism

____11. Completeness of Drawing

____12. Style or Workmanship

____13. Professionalism

Suggested Grading of Parameters

All items shown above will be rated on a scale of 0-4. All items will be averaged for a total rating. 0=F, 1=D, 2=C, 3=B and 4=A.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

j. Estimating space requirements
k. Schematic diagram practices and layout procedures
l. Integrated circuits
m. Reference information

TASK

DDIII-17 Laying out, taping up and/or drawing basic printed circuit boards

PERFORMANCE OBJECTIVE

Layout and tape up and/or draw basic printed circuit boards.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Schematic diagrams
b. Printed circuitry processes
c. Materials
d. Specifications
e. Conductor and components
  1. Conductor size
  2. Termination tapes
  3. Specialized conductors in termination tapes
  4. Films and grids
  5. Tape application
  6. Tape and termination pad selection
f. Printed board design
g. Printed board layout

(Continued on back)

Provide Demonstration On:

Techniques for laying out, taping up and/or drawing printed circuit boards

Provide Practical Application On:

Existing printed circuit boards showing good and poor arrangements

INSTRUCTIONAL MATERIALS

Textbooks:

a. Lindsey, The Design and Drafting of Printed Circuits
b. Raskhodoff, Electronic Drafting and Design

Tools and Equipment:

a. Drafting tools
b. Printed circuit board template
c. Dry transfer printed circuit board art work materials (The Datak Corp.)
d. Chartpak (Avery Products Corp.)

LAB HOURS 30

CLASS HOURS 10

EVALUATION (DDIII-17)

Given a basic electronic schematic, reference data, printed circuit art work supplies, drafting supplies and equipment, the student will layout and tape up and/or draw the foil and component side art work necessary for fabricating a printed circuit board. The student must score a "B" or better on all items within the parameters of acceptable drafting practices.

Parameters of Acceptable Drafting Practices

_____1. Lettering

_____2. Line Work

_____3. Correctness of Drawing Construction

_____4. Neatness

_____5. Clarity of Communication

_____6. Design

_____7. Creativity

_____8. Speed

_____9. Correctness of Scale and Dimensioning

____10. Correctness of Symbolism

____11. Completeness of Drawing

____12. Style or Workmanship

____13. Professionalism

Suggested Grading of Parameters

All items shown above will be rated on a scale of 0-4. All items will be averaged for a total rating. 0=F, 1=D, 2=C, 3=B and 4=A.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

h. Component mounting
i. Integrated circuit grouping
j. Multilayer P.C. boards
k. Assembly drawings and parts layout
l. Design reference information

TASK

SMII-01 Calculating centroids of areas

PERFORMANCE OBJECTIVE

Calculate centroids of areas.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Definition and purpose
b. Centroid of simple areas
c. Moment of simple areas
d. Moment of composite areas
e. Centroid of composite areas
f. American Institute of Steel Construction (AISC) handbook

Provide Demonstration On:

Using the AISC handbook

Provide Practical Application On:

Researching centroids for standard structural shapes using the AISC handbook

INSTRUCTIONAL MATERIALS

Textbooks:

a. Bassin, Brodsky and Wolkoff, *Statics and Strength of Materials*
b. Bruch, *Strength of Materials for Technology*
c. Jensen and Chenoweth, *Applied Strength of Materials*
d. Parker and Hauf, *Simplified Design of Structural Steel; Simplified Design of Structural Wood*

Student Manuals:

Parker and Hauf, *Simplified Engineering for Architects and Builders*

Tools and Equipment:

a. Electronic calculator
b. Loose leaf notebook
c. Pencil

LAB HOURS 3
CLASS HOURS 2

EVALUATION (SMII-01)

Given an area, an electronic calculator and reference formulas, the student will locate the centroid within ± .01 inches (.254mm) of the correct values with respect to the x and y reference axle.

TASK

SMII-02 Calculating moment of inertia of areas

PERFORMANCE OBJECTIVE

Calculate moment of inertia of areas.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Definition and purpose of moment of inertia
b. Moments of inertia of simple areas
c. Parallel Axis Theorem
d. Moment of inertia of composite areas

Provide Demonstration On:

Calculating moment of inertia of areas

Provide Practical Application On:

Researching moment of inertia of areas for standard structural shapes using the AISC handbook

INSTRUCTIONAL MATERIALS

Textbooks:

a. Bassin, Brodsky and Wolkoff, Statics and Strength of Materials
b. Bruch, Strength of Materials for Technology
c. Jensen and Chenoweth, Applied Strength of Materials
d. Parker and Hauf, Simplified Design of Structural Steel; Simplified Design of Structural Wood

Student Manuals:

Parker and Hauf, Simplified Engineering for Architects and Builders

Tools and Equipment:

a. Electronic calculator
b. Loose leaf notebook
c. Pencil

LAB HOURS	2
CLASS HOURS	3

EVALUATION (SMII-02)

Given an area, the centroid of the area and reference formulas, the student will calculate the moment of inertia to within ± 1% of the correct values for the x and y reference axis.

TASK

SMII-03 Calculating shear and moment in simple beams

PERFORMANCE OBJECTIVE

Calculate shear and moment in simple beams.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of beams
b. Loads on beams
c. Beam-support reactions
d. Shear and moment in beams
e. Critical section in beams (section of maximum moment)

Provide Demonstration On:

Calculating shear and moments in beams

Provide Practical Application On:

a. Checking existing beam designs found in commercial and industrial applications
b. Designing beams for applications found in the commercial building

INSTRUCTIONAL MATERIALS

Textbooks:

a. American Institute of Timber Construction, *Timber Construction Manual*
b. Bassin, Brodsky and Wolkoff, *Statics and Strength of Materials*
c. Bruch, *Strength of Materials for Technology*
d. Jensen and Chenoweth, *Applied Strength of Materials*
e. Parker and Hauf, *Simplified Design of Structural Steel; Simplified Design of Structural Wood*

Student Manuals:

Parker and Hauf, *Simplified Engineering for Architects and Builders*

Tools and Equipment:

a. Electronic calculator
b. Loose leaf notebook
c. Pencil

LAB HOURS	3
CLASS HOURS	2

EVALUATION (SMII-03)

Given the design loading data on a simple beam, reference formulas and an electronic calculator, the student will calculate the shearing forces and bending moments necessary to locate critical cross sections for beam design. The calculations for this task must be completed with 100% accuracy.

TASK

SMII-04 Calculating bending and shearing stresses in simple beams

PERFORMANCE OBJECTIVE

Calculate bending and shearing stresses in simple beams.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Tensile and compressive stresses
b. Bending stresses
c. Tiber stresses
d. Hooke's law
e. Neutral axis of bending
f. The flexure formula
g. Review of centroids
h. Review of moment of inertia
i. Section modulus
j. Shearing stresses (vertical and horizontal)
k. General shear formula
l. Special shear formulas
    1. Rectangular-area
    2. Circular-area
    3. Web shear

Provide Demonstration On:

Calculating bending and shear stresses in beams

Provide Practical Application On:

a. Checking existing beam designs found in commercial buildings
b. Designing beams for applications found in the commercial building

INSTRUCTIONAL MATERIALS

Textbooks:

a. American Institute of Timber Construction, Timber Construction Manual
b. Bassin, Brodsky and Wolkoff, Statics and Strength of Materials
c. Bruch, Strength of Materials for Technology
d. Jensen and Chenoweth, Applied Strength of Materials
e. Parker and Hauf, Simplified Design of Structural Steel; Simplified Design of Structural Wood

Student Manuals:

a. Parker and Hauf, Simplified Engineering for Architects and Builders
b. AISC, Manual of Steel Construction

Tools and Equipment:

a. Electronic calculator
b. Loose leaf notebook
c. Pencil

LAB HOURS 3

CLASS HOURS 2

EVALUATION (SMII-04)

Given the design loading data on a simple beam, reference formulas and an electronic calculator, the student will calculate the shearing and bending stresses required to design a working cross section. The calculations for this task must be completed with a 100% accuracy.

248

TASK

SMII-05 Designing simple wood or steel beams of standard cross section

PERFORMANCE OBJECTIVE

Design simple wood or steel beams of standard cross section.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Structural shapes: W, M, S, HP, C, MC and L
b. Properties of sample wood sections
c. Bending stress in standard sections
d. Design of beams of standard section procedure
e. Shearing stress in standard sections

Provide Demonstration On:

Designing beams

Provide Practical Application On:

a. Checking existing beam designs found in commercial and industrial applications
b. Designing beams for applications found in the commercial building

INSTRUCTIONAL MATERIALS

Textbooks:

a. American Institute of Timber Construction, *Timber Construction Manual*
b. Bassin, Brodsky and Wolkoff, *Statics and Strength of Materials*
c. Bruch, *Strength of Materials for Technology*
d. Jensen and Chenoweth, *Applied Strength of Materials*
e. Parker and Hauf, *Simplified Design of Structural Steel; Simplified Design of Structural Wood*

Student Manuals:

a. Parker and Hauf, *Simplified Engineering for Architects and Builders*
b. AISC, *Manual of Steel Construction*

Tools and Equipment:

a. Electronic calculator
b. Loose leaf notebook
c. Pencil

LAB HOURS	3
CLASS HOURS	2

EVALUATION (SMII-05)

Given the design loading data on a simple beam, reference formulas and electronic calculator, the student will design simple wood or steel beams of standard cross section. The calculations for this task must be complete with an accuracy of 100%.

250

TASK

SMII-06 Calculating deflection of simple beams

PERFORMANCE OBJECTIVE

Calculate deflection of simple beams.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Definition of deflection
b. Collection of formulas for beam deflection
c. Beam deflection by superposition
d. Beam deflection by reference tables

Provide Demonstration On:

Calculating deflection of simple beams

Provide Practical Application On:

a. Checking existing beam for deflection as found in commercial and industrial applications
b. Designing beams for applications found in the commercial building

INSTRUCTIONAL MATERIALS

Textbooks:

a. American Institute of Timber Construction, *Timber Construction Manual*
b. Bassin, Brodsky and Wolkoff, *Statics and Strength of Materials*
c. Bruch, *Strength of Materials for Technology*
d. Jensen and Chenoweth, *Applied Strength of Materials*
e. Parker and Hauf, *Simplified Design of Structural Steel; Simplified Design of Structural Wood*

Student Manuals:

a. Parker and Hauf, *Simplified Engineering for Architects and Builders*
b. AISC, *Manual of Steel Construction*

Tools and Equipment:

a. Electronic calculator
b. Loose leaf notebook
c. Pencil

LAB HOURS 4

CLASS HOURS 1

EVALUATION (SMII-06)

Given the design loading data on a simple beam, reference formulas and an electronic calculator, the student will calculate maximum deflection of a simple beam. The calculations for this task must be completed with 100% accuracy.

TASK

SMII-07 Designing structural cross sections for statically indeterminate beams

PERFORMANCE OBJECTIVE

Design structural cross sections for statically indeterminate beams from standard formulas.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Definition and purpose
b. Types of supports and reactions
c. Fixed beams
d. Continuous beams
e. Formulas for continuous beams over two, three, four and five continuous spans

Provide Demonstration On:

Information items using the overhead projector and chalkboard

Provide Practical Application On:

Checking existing statically indeterminate beams found in commercial and industrial applications

INSTRUCTIONAL MATERIALS

Textbooks:

a. Bassin, Brodsky and Wolkoff, Statics and Strengths of Materials
b. Bruch, Strength of Materials for Technology
c. Jensen and Chenoweth, Applied Strength of Materials

Student Manuals:

a. Parker and Hauf, Simplified Engineering for Architects and Builders
b. AISC, Manual of Steel Construction

Tools and Equipment:

a. Electronic calculator
b. Loose leaf notebook
c. Pencil

LAB HOURS	4
CLASS HOURS	1

EVALUATION (SMII-07)

Given the design loading data, reference formulas, an electronic calculator and material working stress data, the student will design a structural cross section for shearing and bending forces on a statically indeterminate beam. The calculations for this task must be completed with 100% accuracy.

TASK

SMII-08 Designing structural cross sections for simple steel and wood columns

PERFORMANCE OBJECTIVE

Design structural cross sections for simple steel and wood columns from standard formulas.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Definition and purpose
b. Types of loading
c. Types of column cross sections
d. Radium of gyration
e. Slenderness ratio
f. Short, intermediate and long columns
g. Formulas for steel columns
    1. Euler's formula
    2. Gordon-Rankine formula
h. Formulas for wood columns
    1. National Forest Product Association formula
    2. Forest-Products Laboratory formula
i. Designing steel columns from the AISC handbook

Provide Demonstration On:

Designing structural cross sections

Provide Practical Application On:

a. Checking existing column designs found in commercial and industrial applications
b. Designing columns for applications found in the commercial building

INSTRUCTIONAL MATERIALS

Textbooks:

a. Ambrose, Simplified Design of Building Structures
b. Bassin, Brodsky and Wolkoff, Statics and Strength of Materials
c. Bruch, Strength of Materials for Technology
d. Jensen and Chenoweth, Applied Strength of Materials
e. Parker and Hauf, Simplified Design of Structural Wood

Student Manuals:

a. Parker and Hauf, Simplified Engineering for Architects and Builders
b. AISC, Manual of Steel Construction

Tools and Equipment:

a. Electronic calculator
b. Loose leaf notebook
c. Pencil

LAB HOURS	3
CLASS HOURS	2

EVALUATION (SMII-08)

Given the design loading data, reference formulas, electronic calculator and material working stress data, the student will design structural cross sections for simple steel and wood columns. The calculations for this task must be completed with an accuracy of 100%.

TASK

SMII-09 Calculating bending stress with tensile or compressive stress in beams and columns

PERFORMANCE OBJECTIVE

Calculate bending stress with tensile or compressive stress in beams and columns.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Review of centroid of areas
b. Review of moment of inertia of areas
c. Review of axial force and axial stress
d. Review of bending and bending stress
e. Beams with axial loads
f. Eccentric loads

Provide Demonstration On:

Calculating bending stress with tensile or comprehensive stress

Provide Practical Application On:

a. Checking existing structural members that incorporate bending with tension or compression
b. Designing structural members for application in the commercial building

INSTRUCTIONAL MATERIALS

Textbooks:

a. Bassin, Brodsky and Wolkoff, Statics and Strength of Materials
b. Bruch, Strength of Materials for Technology
c. Jensen and Chenoweth, Applied Strength of Materials

Student Manuals:

a. Parker and Hauf, Simplified Engineering for Architects and Builders
b. AISC, Manual of Steel Construction

Tools and Equipment:

a. Electronic calculator
b. Loose leaf notebook
c. Pencil

LAB HOURS	3
CLASS HOURS	2

EVALUATION (SMII-09)

Given the design loading data, reference formulas, electronic calculator and working stress data, the student will calculate bending stress with tensile or compressive stress in beams or columns. This task must be completed with an accuracy of 100%.

TASK

SMII-10 Calculating torsional stresses in circular shafts

PERFORMANCE OBJECTIVE

Calculate torsional stresses in circular shafts.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Twisting moments-torque
b. Stresses in circular shafts - the torsion formula
c. Analysis of design of circular shafts
d. Shaft couplings
e. Angle of twist
f. Power transmission by shafts

Provide Demonstration On:

Calculating torsional stresses in circular shafts

Provide Practical Application On:

Existing shaft designs found in commercial and industrial applications

INSTRUCTIONAL MATERIALS

Textbooks:

a. Bassin, Brodsky and Wolkoff, *Statics and Strength of Materials*
b. Bruch, *Strength of Materials for Technology*
c. Jensen and Chenoweth, *Applied Strength of Materials*

Tools and Equipment:

a. Electronic calculator
b. Loose leaf notebook
c. Pencil

LAB HOURS 5

CLASS HOURS 2

EVALUATION (SMII-10)

Given the design shaft loading data, reference formulas and electronic calculator, the student will calculate torsional stresses in circular shafts. This task must be completed with an accuracy of 100%.

TASK

DDIV-01 Analyzing the operation of gas and electric hot air heating and electric air cooling systems

PERFORMANCE OBJECTIVE

Analyze the operation of gas and electric hot air heating and electric air cooling systems for residence and small commercial buildings.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Placement of heating and cooling units
b. Types of forced air systems
c. Types of distribution systems
d. Electric hot air heating systems
e. Gas hot air heating systems
f. Electric cooling systems
g. Heat pump systems
h. Heating and cooling load calculations

Provide Demonstration On:

Information items using the overhead and filmstrip projectors and the chalkboard

Provide Practical Application On:

Existing heating and cooling systems in residence and small commercial buildings

INSTRUCTIONAL MATERIALS

Textbooks:

a. McGuinness and Stein, Building Technology: Mechanical and Electrical Systems
b. Muller, Architectural Drawing and Light Construction
c. Spence, Architecture: Design-Engineering-Drawing

Tools and Equipment:

a. Pencil
b. Paper
c. Loose leaf notebook

LAB HOURS	0
CLASS HOURS	5

EVALUATION (DDIV-01)

Given a written evaluation and necessary time, the student will answer questions concerning the operation of gas and electric hot air and electric air cooling systems found in residences and small commercial buildings. The student is expected to score at least 85%.

TASK

DDIV-02 Drawing heating, cooling and ventilating duct systems

PERFORMANCE OBJECTIVE

Draw heating, cooling and ventilating duct systems from engineering sketches.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. HVAC graphic symbols and abbreviations
b. Existing duct layouts
c. Duct system design
d. Commercial and residential working drawings
e. Vendor HVAC materials catalogs
f. Heating and cooling load calculations

Provide Demonstration On:

Information items using the overhead projector

Provide Practical Application On:

a. Reading existing HVAC system drawing
b. HVAC system duct drawing

INSTRUCTIONAL MATERIALS

Textbooks:

a. McGuiness and Stein, Building Technology: Mechanical and Electrical Systems
b. Traister, Practical Drafting for the HVAC Trades

Student Manuals:

Georgia, Drafting, Advanced, Unit 9-A

Tools and Equipment:

Drafting tools

LAB HOURS	14
CLASS HOURS	1

EVALUATION (DDIV-02)

a. Given engineering duct system sketches, the student will prepare a finished working drawing acceptable to ASHRAE (American Society of Heating, Refrigeration and Air Conditioning Engineers). The student is expected to score a "B" on all items within the parameters of acceptable drafting practices.

b. Georgia, Drafting, Advanced, Instructor Guide, Unit 9-A.

Parameters of Acceptable Drafting Practices

_____1. Lettering

_____2. Line Work

_____3. Correctness of Drawing Construction

_____4. Neatness

_____5. Clarity of Communication

_____6. Design

_____7. Creativity

_____8. Speed

_____9. Correctness of Scale and Dimensioning

____10. Correctness of Symbolism

____11. Completeness of Drawing

____12. Style or Workmanship

____13. Professionalism

Suggested Grading of Parameters

All items shown above will be rated on a scale of 0-4. All items will be averaged for a total rating. 0=F, 1=D, 2=C, 3=B and 4=A.

TASK

DDIV-03 Drawing heating, cooling and ventilating system details

PERFORMANCE OBJECTIVE

Draw heating, cooling and ventilating system from engineering sketches.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. HVAC graphic symbols and abbreviations
b. Existing HVAC details
c. Commercial and residential working drawings
d. Vendor HVAC material catalogs

Provide Demonstration On:

a. Information items on the overhead projector and/or chalkboard
b. Techniques for HVAC detailing

Provide Practical Application On:

a. Existing HVAC systems details
b. Commercial building project

INSTRUCTIONAL MATERIALS

Textbooks:

a. McGuinness and Stein, Building Technology: Mechanical and Electrical Systems
b. Traister, Practical Drafting for the HVAC Trades

Student Manuals:

Georgia, Drafting, Advanced, Unit 9-A

Tools and Equipment:

Drafting tools

LAB HOURS 14

CLASS HOURS 1

EVALUATION (DDIV-03)

a. Given engineering heating, cooling and ventilating detail sketches, the student will prepare a working drawing acceptable to ASHRAE (American Society of Heating, Refrigeration and Air Conditioning Engineers). The student is expected to score a "B" on all items within the parameters of acceptable drafting practices.

b. Georgia, Drafting, Advanced, Instructor Guide, Unit 9-A.

Parameters of Acceptable Drafting Practices

_____1. Lettering

_____2. Line Work

_____3. Correctness of Drawing Construction

_____4. Neatness

_____5. Clarity of Communication

_____6. Design

_____7. Creativity

_____8. Speed

_____9. Correctness of Scale and Dimensioning

____10. Correctness of Symbolism

____11. Completeness of Drawing

____12. Style or Workmanship

____13. Professionalism

Suggested Grading of Parameters

All items shown above will be rated on a scale of 0-4. All items will be averaged for a total rating. 0=F, 1=D, 2=C, 3=B and 4=A.

TASK

DDIV-04 Analyzing plumbing systems

PERFORMANCE OBJECTIVE

Analyze plumbing systems for residences and small commercial buildings.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Uniform plumbing code
b. Waste disposal system
c. Plumbing symbols
d. Sizing drains, soil pipes and waste pipes
e. Computing sewer size
f. Computing horizontal fixture branches
g. Computing soil pipes
h. Traps, vents, septic tanks
i. Cold water system
j. Hot water system
k. Plumbing fixtures
l. Storm drainage and disposal
m. Solar hot water heating

Provide Demonstration On:

Information items using overhead projector and chalkboard

Provide Practical Application On:

a. Reading existing residential and commercial plumbing plans
b. Commercial building design

INSTRUCTIONAL MATERIALS

Textbooks:

a. McGuinness and Stein, *Building Technology: Mechanical and Electrical Systems*
b. Muller, *Architectural Drawing and Light Construction*
c. Spence, *Architecture: Design-Engineering-Drawing*
d. Traister, *Practical Plumbing Drafting*

Student Manuals:

Georgia, *Drafting, Advanced*, Unit 8-A

Tools and Equipment:

a. Pencil
b. Paper
c. Loose leaf notebook

LAB HOURS 0

CLASS HOURS 5

EVALUATION (DDIV-04)

a. Given a written evaluation, the student will answer questions concerning the operation of plumbing systems for residences and small commercial buildings. The student is expected to score at least 85%.

b. Georgia, Drafting, Advanced, Instructor Guide, Unit 8-A.

TASK

DDIV-05 Drawing water distribution and sanitary drainage systems for residences

PERFORMANCE OBJECTIVE

Draw water distribution and sanitary drainage systems for residences from engineering sketches.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Uniform plumbing code
b. Waste disposal system
c. Plumbing symbols
d. Sizing drains, soil pipe and waste pipes
e. Computing sewer sizes
f. Computing horizontal fixture branches
g. Computing soil pipes
h. Traps, vents, septic tanks
i. Cold water system
j. Hot water system
k. Plumbing fixtures
l. Storm drainage and disposal
m. Solar hot water heating

Provide Demonstration On:

Techniques in laying out plumbing systems

Provide Practical Application On:

a. Existing residential and commercial plumbing plans
b. Commercial building designs

INSTRUCTIONAL MATERIALS

Textbooks:

a. McGuinness and Stein, Building Technology: Mechanical and Electrical Systems
b. Muller, Architectural Drawing and Light Construction
c. Spence, Architecture: Design-Engineering-Drawing
d. Traister, Practical Plumbing Drafting

Student Manuals:

Georgia, Drafting, Advanced, Unit 8-A

Tools and Equipment:

a. Drafting tools
b. Plumbing template

LAB HOURS 14

CLASS HOURS 1

EVALUATION (DDIV-05)

a. Given engineering sketches, the student will prepare a residential working drawing of a water distribution system and a sanitary drainage system acceptable to the American Society of Plumbing Engineers. The student is expected to score a "B" or better on all items within the parameters of acceptable drafting practices.

b. Georgia, Drafting, Advanced, Instructor Guide, Unit 8-A.

Parameters of Acceptable Drafting Practices

_____1. Lettering
_____2. Line Work
_____3. Correctness of Drawing Construction
_____4. Neatness
_____5. Clarity of Communication
_____6. Design
_____7. Creativity
_____8. Speed
_____9. Correctness of Scale and Dimensioning
____10. Correctness of Symbolism
____11. Completeness of Drawing
____12. Style or Workmanship
____13. Professionalism

Suggested Grading of Parameters

All items shown above will be rated on a scale of 0-4. All items will be averaged for a total rating. 0=F, 1=D, 2=C, 3=B and A=4.

TASK

DDIV-06 Drawing water distribution and sanitary drainage systems for small commercial buildings

PERFORMANCE OBJECTIVE

Draw water distribution and sanitary drainage systems for a small commercial building from engineering sketches.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Uniform plumbing code
b. Waste disposal system
c. Plumbing symbols
d. Sizing drains, soil pipe and waste pipes
e. Computing sewer sizes
f. Computing horizontal fixture branches
g. Computing soil pipes
h. Traps, vents, septic tanks
i. Cold water system
j. Hot water system
k. Plumbing fixtures
l. Storm drainage and disposal
m. Solar hot water heating

Provide Demonstration On:

Technique in laying out plumbing systems

Provide Practical Application On:

a. Existing residential and commercial plumbing plans
b. Commercial building designs

INSTRUCTIONAL MATERIALS

Textbooks:

a. McGuinness and Stein, Building Technology: Mechanical and Electrical Systems
b. Muller, Architectural Drawing and Light Construction
c. Spence, Architecture: Design-Engineering-Drawing
d. Traister, Practical Plumbing Drafting

Tools and Equipment:

Drafting tools

LAB HOURS 14
CLASS HOURS 1

EVALUATION DDIV-06)

Given engineering sketches, the student will prepare a commercial working drawing of a water distribution system and a sanitary drainage system acceptable to the American Society of Plumbing Engineers. The student is expected to score a "B" on all items within the parameters of acceptable drafting practices.

Parameters of Acceptable Drafting Practices

_____1. Lettering

_____2. Line Work

_____3. Correctness of Drawing Construction

_____4. Neatness

_____5. Clarity of Communication

_____6. Design

_____7. Creativity

_____8. Speed

_____9. Correctness of Scale and Dimensioning

____10. Correctness of Symbolism

____11. Completeness of Drawing

____12. Style or Workmanship

____13. Professionalism

Suggested Grading of Parameters

All items shown above will be rated on a scale of 0-4. All items will be averaged for a total rating. 0=F, 1=D, 2=C, 3=B and 4=A.

TASK

DDIV-07 Researching data for drawing a process piping working drawing

PERFORMANCE OBJECTIVE

Research data for drawing a process piping working drawing.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. ANSI
b. Pipe diameters, thickness and schedule
c. Pipe fittings
d. Valves
e. Symbols
f. Vendor catalogs

Provide Demonstration On:

Researching data for a specific design situation

Provide Practical Application On:

Existing specifications for process piping systems

INSTRUCTIONAL MATERIALS

Textbooks:

a. Jensen and Helsel, Engineering Drawing and Design
b. Weaver, Process Piping Design, Vols. 1 and 2; Process Piping Drafting

Tools and Equipment:

a. Pencil
b. Paper
c. Loose leaf notebook

LAB HOURS 0
CLASS HOURS 5

EVALUATION (DDIV-07)

Given sufficient reference sources, the student will research data for drawing a process piping working drawing acceptable to the process piping engineering profession. The student must research this data with a 100% accuracy.

TASK

DDIV-08 Drawing process piping flow diagrams using standard piping and instrumentation symbols

PERFORMANCE OBJECTIVE

Draw process piping flow diagrams from engineering sketches using standard piping and instrumentation symbols.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Flow diagram instrument symbols
b. Flow diagram piping symbols
c. Flow diagram abbreviations
d. Flow diagram examples
    1. Process flow
    2. Mechanical flow
    3. Utility flow

Provide Demonstration On:

Techniques for drawing flow diagrams

Provide Practical Application On:

Existing flow diagrams utilizing correct symbols and abbreviations

INSTRUCTIONAL MATERIALS

Textbooks:

a. Jensen and Helsel, Engineering Drawing and Design
b. Weaver, Process Piping Design, Vols. 1 and 2; Process Piping Drafting

Tools and Equipment:

a. Drafting tools
b. Process piping template

LAB HOURS	14
CLASS HOURS	1

EVALUATION (DDIV-08)

Using the drafting kit and reference data, the student will draw process piping flow diagrams from engineering sketches using standard piping and instrumentation symbols. The student is expected to score a "B" or better on all items within the parameters of acceptable drafting practices. This drawing should be acceptable to the process piping engineering profession.

Parameters of Acceptable Drafting Practices

_____ 1. Lettering

_____ 2. Line Work

_____ 3. Correctness of Drawing Construction

_____ 4. Neatness

_____ 5. Clarity of Communication

_____ 6. Design

_____ 7. Creativity

_____ 8. Speed

_____ 9. Correctness of Scale and Dimensioning

_____10. Correctness of Symbolism

_____11. Completeness of Drawing

_____12. Style or Workmanship

_____13. Professionalism

Suggested Grading of Parameters

All items shown above will be rated on a scale of 0-4. All items will be averaged for a total rating. 0=F, 1=D, 2=C, 3=B and 4=A.

TASK

DDIV-09 Drawing isometric process piping diagrams

PERFORMANCE OBJECTIVE

Draw isometric process piping diagrams from engineering sketches using standard symbols.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Definition and purpose
b. North reference procedure
c. Isometric symbols and conventions
d. Dimensioning procedures
e. Lettering in isometric
f. Spool call-outs
g. Piping specifications
h. Vendor catalogs

Provide Demonstration On:

Techniques on drawing isometric process piping diagrams

Provide Practical Application On:

Existing isometric process piping diagrams

INSTRUCTIONAL MATERIALS

Textbooks:

a. Jensen and Helsel, Engineering Drawing and Design
b. Weaver, Process Piping Design, Vols. 1 and 2; Process Piping Drafting

Tools and Equipment:

a. Drafting tools
b. Isometric process piping template

LAB HOURS	18
CLASS HOURS	2

EVALUATION (DDIV-09)

Using the drafting kit, reference data and engineering sketches, the student will draw isometric process piping diagrams using standard symbols. The student is expected to score a "B" or better on all items within the parameters of acceptable drafting practices. This drawing should be acceptable to the process piping engineering profession.

Parameters of Acceptable Drafting Practices

_____1. Lettering
_____2. Line Work
_____3. Correctness of Drawing Construction
_____4. Neatness
_____5. Clarity of Communication
_____6. Design
_____7. Creativity
_____8. Speed
_____9. Correctness of Scale and Dimensioning
____10. Correctness of Symbolism
____11. Completeness of Drawing
____12. Style or Workmanship
____13. Professionalism

Suggested Grading of Parameters

All items shown above will be rated on a scale of 0-4. All items will be averaged for a total rating. 0=F 1=D, 2=C, 3=B and 4=A.

TASK

DDIV-10 Drawing orthographic process piping drawings using standard symbols

PERFORMANCE OBJECTIVE

Draw orthographic process piping drawings from engineering sketches using standard symbols.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Definition and purpose
b. Orthographic piping symbols and conventions
c. Dimensioning procedures
d. Sections
e. Single line and double line drawings
f. Vendor catalogs

Provide Demonstration On:

Techniques on drawing orthographic process piping drawings

Provide Practical Application On:

Existing orthographic process piping drawings

INSTRUCTIONAL MATERIALS

Textbooks:

a. Jensen and Helsel, Engineering Drawing and Design
b. Weaver, Process Piping Design, Vols. 1 and 2; Process Piping Drafting

Tools and Equipment:

Drafting tools

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LAB HOURS	18
CLASS HOURS	2

EVALUATION (DDIV-10)

Using the drafting kit, reference data and engineering sketches, the student will draw orthographic process piping diagrams using standard symbols. The student is expected to score a "B" or better on all items within the parameters of acceptable drafting practices. This drawing should be acceptable to the process piping engineering profession.

Parameters of Acceptable Drafting Practices

_____1. Lettering

_____2. Line Work

_____3. Correctness of Drawing Construction

_____4. Neatness

_____5. Clarity of Communication

_____6. Design

_____7. Creativity

_____8. Speed

_____9. Correctness of Scale and Dimensioning

____10. Correctness of Symbolism

____11. Completeness of Drawing

____12. Style or Workmanship

____13. Professionalism

Suggested Grading of Parameters

All items shown above will be rated on a scale of 0-4. All items will be averaged for a total rating. 0=F, 1=D, 2=C, 3=B and 4=A.

TASK

DDIV-11 Describing the production and fabrication of structural steel

PERFORMANCE OBJECTIVE

Describe the production and fabrication of structural steel.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Raw materials
b. Blast furnace
c. Pig iron
d. Electric, basic oxygen or open hearth
e. Ingots and soaking pits
f. Blooms, billets, slabs
g. Continuous casting
h. Roughing and finishing
i. Rolling schedule for plain materials
j. Sheared and universal mill plates
k. Floor plates
l. Square and round bars
m. Continuous mill

(Continued on back)

Provide Demonstration On:

Production and fabrication of structural steel from raw materials to finished materials using the slide, overhead, filmstrip and 16mm movie projector

Provide Practical Application On:

a. Sample mill products
b. Local field trips to industries utilizing plain materials

INSTRUCTIONAL MATERIALS

Textbooks:

a. American Institute of Steel Construction, *Manual of Steel Construction*; *Structural Steel Detailing*
b. Jensen and Helsel, *Engineering Drawing and Design*
c. Weaver, *Structural Drafting*

Tools and Equipment:

a. Pencil
b. Paper
c. Loose leaf notebook

LAB HOURS	0
CLASS HOURS	5

EVALUATION (DDIV-11)

Given a written evaluation, the student will answer questions concerning the production and fabrication of structural steel. The student is expected to score at least 85%.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

n. Cast irons
o. Carbon steels
p. Classification bodies
   (CSA, SAE, AISI, ASME and
   ASTM)
q. Pipe and tubing
r. Mill tolerances

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TASK

DDIV-12 Identifying and billing structural steel plain materials

PERFORMANCE OBJECTIVE

Identify and bill structural steel plain materials.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. American standard beams
b. American standard channels
c. Miscellaneous channels
d. Wide-flange shapes
e. Miscellaneous shapes
f. Structural tees
g. Angles
h. Plates
i. ASTM specifications
j. Billing standards
k. Physical properties
l. Characteristics

Provide Demonstration On:

Information items using the overhead and/or chalkboard

Provide Practical Application On:

a. Sample plain materials
b. Sample bill of materials

INSTRUCTIONAL MATERIALS

Textbooks:

a. American Institute of Steel Construction, Manual of Steel Construction; Structural Steel Detailing
b. Jensen and Helsel, Engineering Drawing and Design
c. Weaver, Structural Drafting

Tools and Equipment:

a. Pencil
b. Paper
c. Loose leaf notebook

LAB HOURS	0
CLASS HOURS	5

EVALUATION (DDIV-12)

Given a written evaluation and necessary time, the student will answer questions concerning the identification and billing procedures for structural steel plain materials. The student is expected to score at least 85%.

TASK

DDIV-13 Researching specifications, grades and tolerances for structural steel

PERFORMANCE OBJECTIVE

Research specifications, grades and tolerances for structural steel.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Grades by ASTM specs
b. Allowable stresses
c. Combined stresses
d. Stability and slenderness ratios
e. Width-thickness ratios
f. Plate girder and rolled beams
g. Simple and continuous spans
h. Deflection
i. Gross and net sections
j. Rivets and bolts
k. Welds
l. Expansion
m. Bases (columns)

(Continued on back)

Provide Demonstration On:

Selected information utilizing various media

Provide Practical Application On:

Existing specifications, grades and tolerances

INSTRUCTIONAL MATERIALS

Textbooks:

a. American Institute of Steel Construction, Manual of Steel Construction; Structural Steel Detailing
b. Jensen and Helsel, Engineering Drawing and Design
c. Parker and Hauf, Simplified Design of Structural Steel
d. Weaver, Structural Drafting

Tools and Equipment:

a. Pencil
b. Paper
c. Loose leaf notebook

LAB HOURS 0
CLASS HOURS 5

EVALUATION (DDIV-13)

Given a written evaluation and necessary time, the student will answer questions concerning specificatons, grades and tolerances for structural steel. The student is expected to score at least 85%.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

n. Anchor bolts
o. Painting
p. Quality Control
q. Rolling tolerances
r. Cutting tolerances

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TASK

DDIV-14 Researching properties and detailing dimensions for structural steel

PERFORMANCE OBJECTIVE

Research properties and detailing dimensions for structural steel from the AISC handbook.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Designations
b. Area of cross section
c. Depth, width, flange thickness and web thickness
d. Moment of inertia with respect to S and Y axis
e. Section modulus
f. Radius of gyration
g. Weight per foot
h. Dimensions for detailing

Provide Demonstration On:

Information items using hypothetical design situations on beam and column problems

Provide Practical Application On:

Information items using existing design situations

INSTRUCTIONAL MATERIALS

Textbooks:

a. American Institute of Steel Construction, Manual of Steel Construction; Structural Steel Detailing
b. Jensen and Helsel, Engineering Drawing and Design
c. Weaver, Structural Drafting

Tools and Equipment:

a. Pencil
b. Paper
c. Loose leaf notebook

LAB HOURS	0
CLASS HOURS	5

EVALUATION (DDIV-14)

Given a written evaluation and necessary time, the student will answer questions concerning physical properties and detailing dimensions for structural steel from the AISC handbook. The student is expected to score at least 85%.

TASK

DDIV-15 Analyzing welding processes and researching welding symbols for structural steel

PERFORMANCE OBJECTIVE

Analyze welding processes and research welding symbols for structural steel.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Welding processes
b. Welding electrodes
c. Weld types
d. Joint prequalification
e. Welding positions
f. Basic weld symbols
g. Supplementary weld symbols
h. Standard location of elements of a welding symbol
i. Stresses in welds
j. Limitations on length of filet welds
k. American Welding Society

Provide Demonstration On:

Information items using the overhead and filmstrip projectors and chalkboard

Provide Practical Application On:

Existing structural designs showing processes and symbols

INSTRUCTIONAL MATERIALS

Textbooks:

a. American Institute of Steel Construction, Manual of Steel Construction; Structural Steel Detailing
b. Jensen and Helsel, Engineering Drawing and Design
c. Weaver, Structural Drafting

Tools and Equipment:

a. Pencil
b. Paper
c. Loose leaf notebook

LAB HOURS 0

CLASS HOURS 13

EVALUATION (DDIV-15)

Given a written evaluation and necessary time, the student will answer questions concerning welding processes and symbols for structural steel. The student is expected to score at least 85%.

TASK

DDIV-16 Aiding the structural engineer in designing and drawing framed and seated beam connections (bolted or riveted)

PERFORMANCE OBJECTIVE

Aid the structural engineer in designing and drawing framed and seated bolted or riveted connections.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Design drawings
b. Shop drawings
c. Nomenclature
d. Framed beam connections (bolted or riveted)
e. Connection angle details
f. Beam gages
g. Cutting for clearance
h. Dimensioning
i. Shipping marks, billing and notes
j. Right and left hand details
k. Typical framed beam details (bolted or riveted)

(Continued on back)

Provide Demonstration On:

a. Designing procedures for framed and seated beam connections (bolted or riveted)
b. Drawing techniques for framed and seated beam connections (bolted or riveted)

Provide Practical Application On:

Existing seated and/or framed beam connections (bolted or riveted)

INSTRUCTIONAL MATERIALS

Textbooks:

a. American Institute of Steel Construction, Manual of Steel Construction; Structural Steel Detailing
b. Jensen and Helsel, Engineering Drawing and Design
c. Weaver, Structural Drafting

Tools and Equipment:

Drafting tools

LAB HOURS	10
CLASS HOURS	5

EVALUATION (DDIV-16)

Given proper reference data, electronic calculator, drafting supplies and equipment and necessary time, the student will aid the structural engineer in designing and drawing bolted or riveted framed and seated beam connections. The student is expected to score a minimum of a "B" on all items within the parameters of acceptable drafting practices.

Parameters of Acceptable Drafting Practices

_____1. Lettering

_____2. Line Work

_____3. Correctness of Drawing Construction

_____4. Neatness

_____5. Clarity of Communication

_____6. Design

_____7. Creativity

_____8. Speed

_____9. Correctness of Scale and Dimensioning

____10. Correctness of Symbolism

____11. Completeness of Drawing

____12. Style or Workmanship

____13. Professionalism

Suggested Grading of Parameters

All items shown above will be rated on a scale of 0-4. All items will be averaged for a total rating. 0=F, 1=D, 2=C, 3=B and 4=A.

Task DDIV-16

INSTRUCTIONAL ACTIVITIES

Provide Information On:

l. Framed connection to columns
m. Seated beam connections
n. Typical beam details using seated connections
o. Clearance for field work

TASK

DDIV-17 Aiding the structural engineer in designing and drawing welded framed and seated beam connections

PERFORMANCE OBJECTIVE

Aid the structural engineer in designing and drawing welded framed and seated beam connections.

INSTRUCTIONAL ACTIVITIES

Provide Information On

a. Procedures for designing connections
b. Clearance for welding
c. Typical framed details (welded)
d. Methods for giving field instructions
e. Seated beam connections (welded)

Provide Demonstration On:

a. Designing procedures for framed and seated connections
b. Drawing techniques for framed and seated beam connections

Provide Practical Application On:

Existing seated and or framed beam connections (welded)

INSTRUCTIONAL MATERIALS

Textbooks:

a. American Institute of Steel Construction, Manual of Steel Construction; Structural Steel Detailing
b. Jensen and Helsel, Engineering Drawing and Design
c. Weaver, Structural Drafting

Tools and Equipment:

Drafting tools

LAB HOURS 10
CLASS HOURS 5

EVALUATION (DDIV-17)

Given reference data, proper drafting equipment and supplies and necessary time, the student will draw structural steel column details. The student is expected to score a minimum of a "B" on all items within the parameters of acceptable drafting practices.

Parameters of Acceptable Drafting Practices

_____1. Lettering

_____2. Line Work

_____3. Correctness of Drawing Construction

_____4. Neatness

_____5. Clarity of Communication

_____6. Design

_____7. Creativity

_____8. Speed

_____9. Correctness of Scale and Dimensioning

____10. Correctness of Symbolism

____11. Completeness of Drawing

____12. Style or Workmanship

____13. Professionalism

Suggested Grading of Parameters

All items shown above will be rated on a scale of 0-4. All items will be averaged for a total rating. 0=F, 1=D, 2=C, 3=B and 4=A.

TASK

DDIV-18 Drawing structural steel column details

PERFORMANCE OBJECTIVE

Draw structural steel column details.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of columns
b. Design drawings
c. Column schedules
d. Column bases
e. Anchor bolt plan
f. Column splices
g. Lighting hitches
h. Shear connections
i. Framed and seated connections (bolted, riveted or welded)
j. Field clearances
k. Offset and skewed connections
l. Drawing arrangement
m. Column faces

(Continued on back)

Provide Demonstration On:

Information items using various media

Provide Practical Application On:

Existing column designs

INSTRUCTIONAL MATERIALS

Textbooks:

a. American Institute of Steel Construction, Manual of Steel Construction; Structural Steel Detailing
b. Jensen and Helsel, Engineering Drawing and Design
c. Weaver, Structural Drafting

Tools and Equipment:

Drafting tools

LAB HOURS 13
CLASS HOURS 2

EVALUATION (DDIV-18)

Given proper reference data, electronic calculator, drafting supplies and equipment and necessary time, the student will aid the structural engineer in designing and drawing welded frame and seated beam connections. The student is expected to score a minimum of a "B" on all items within the parameters of acceptable drafting practices.

Parameters of Acceptable Drafting Practices

_____1. Lettering

_____2. Line Work

_____3. Correctness of Drawing Construction

_____4. Neatness

_____5. Clarity of Communication

_____6. Design

_____7. Creativity

_____8. Speed

_____9. Correctness of Scale and Dimensioning

____10. Correctness of Symbolism

____11. Completeness of Drawing

____12. Style or Workmanship

____13. Professionalism

Suggested Grading of Parameters

All items shown above will be rated on a scale of 0-4. All items will be averaged for a total rating. 0=F, 1=D, 2=C, 3=B and 4=A.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

n. Sections, markings
o. Right and left hand columns
p. Drafting economy
q. Typical column details

TASK

TSIII-01 Calculating fluid pressure

PERFORMANCE OBJECTIVE

Calculate fluid pressure.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. The Bernovlli principle
b. Mass density and weight density of materials

Provide Practical Application On:

Calculating fluid pressure

INSTRUCTIONAL MATERIALS

Textbooks:

a. Harris and Hemmerling, Introductory Applied Principles
b. Marcus and Thrower, Introduction to Applied Physics
c. Pollack, Applied Physics
d. Zebrowski, Physics for the Technicians

Tools and Equipment:

Calculator

LAB HOURS	3
CLASS HOURS	1

EVALUATION (TSIII-01)

Given the density and velocity of a fluid, the student will use the Bernovlli principle to calculate (within rounding error) the fluid pressure of the fluid.

TASK

TSIII-02 Calculating fluid velocity

PERFORMANCE OBJECTIVE

Calculate fluid velocity.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. The Bernovlli principle
b. Mass density and weight density of materials

Provide Demonstration On:

Calculating the velocity of fluids moving under pressure

INSTRUCTIONAL MATERIALS

Textbooks:

a. Harris and Hemmerling, *Introductory Applied Principles*
b. Marcus and Thrower, *Introduction to Applied Physics*
c. Pollack, *Applied Physics*
d. Zebrowski, *Physics for the Technicians*

Tools and Equipment:

Calculator

LAB HOURS 2
CLASS HOURS 1

EVALUATION (TSIII-02)

Given assignments of fluid moving under pressure, the student will use the Bernovili principle to calculate (within rounding error) the velocity of the fluids.

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TASK

TSIII-03 Calculating buoyant force

PERFORMANCE OBJECTIVE

Calculate buoyant force.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Archimede's principle
b. Density of materials

Provide Practical Application On:

Calculating buoyant force

INSTRUCTIONAL MATERIALS

Textbooks:

a. Harris and Hemmerling, Introductory Applied Principles
b. Marcus and Thrower, Introduction to Applied Physics
c. Pollack, Applied Physics
d. Zebrowski, Physics for the Technicians

Tools and Equipment:

Calculator

LAB HOURS 3

CLASS HOURS 1

EVALUATION (TSIII-03)

Given the density of materials, the student will use Archimede's principle to calculate (within rounding error) the buoyant force on materials.

TASK

TSIII-04 Describing vibrating systems

PERFORMANCE OBJECTIVE

Numerically describe the motion of a system vibrating in simple harmonic motion.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Harmonic motion
b. Springs and pendulums in oscillatory motion
c. Formulas for calculating period and frequency
d. Forced oscillation
e. Amplitude
f. Damping
g. Resonance
h. Equilibrium

Provide Demonstration On:

Harmonic motion

Provide Practical Application On:

Calculating frequency and period of oscillation

INSTRUCTIONAL MATERIALS

Textbooks:

a. Harris and Hemmerling, Introductory Applied Principles
b. Marcus and Thrower, Introduction to Applied Physics
c. Pollack, Applied Physics
d. Zebrowski, Physics for the Technicians

Tools and Equipment:

Calculator

LAB HOURS 5

CLASS HOURS 2

EVALUATION (TSIII-04)

Given a system vibrating in simple harmonic motion, the student will use the appropriate formulas to calculate (within rounding error) the period and frequency of the system.

TASK

TSIII-05 Defining the structure of matter

PERFORMANCE OBJECTIVE

Define the structure of matter.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Elementary particles
b. Fundamental forces
c. The atom
d. Ions
e. Molecules
f. States of matter
g. The elements

INSTRUCTIONAL MATERIALS

Textbooks:

a. Harris and Hemmerling, Introductory Applied Principles
b. Marcus and Thrower, Introduction to Applied Physics
c. Pollack, Applied Physics
d. Zebrowski, Physics for the Technicians

Tools and Equipment:

a. Paper
b. Pencil

LAB HOURS	3
CLASS HOURS	1

EVALUATION (TSIII-05)

The student will accurately communicate in writing, the elementary concept of the structure of matter, naming elementary particles, forces and factors that contribute to the states of matter.

TASK

TSIII-06 Changing units of temperature

PERFORMANCE OBJECTIVE

Change units of temperature.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Temperature as a measure of energy
b. Temperature scales:
   1. Fahrenheit
   2. Rankine
   3. Celsius
   4. Kelvin
c. Formulas for converting temperature scales
d. Fixed points on international practical temperature scales

Provide Demonstration On:

Changing units of temperature from one scale to another

Provide Practical Application On:

Changing temperature scales

INSTRUCTIONAL MATERIALS

Textbooks:

a. Harris and Hemmerling, Introductory Applied Principles
b. Marcus and Thrower, Introduction to Applied Physics
c. Pollack, Applied Physics
d. Zebrowski, Physics for the Technicians

Tools and Equipment:

Calculator

LAB HOURS	1
CLASS HOURS	1

EVALUATION (TSIII-06)

Given formulas for converting temperature scales, the student will convert assigned temperatures as required to: Fahrenheit, Rankine, Celsius or Kelvin with the numerical value correct within rounding error.

TASK

TSIII-07 Calculating thermal expansion

PERFORMANCE OBJECTIVE

Calculate the change in size of an object resulting from a change in temperature

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Coefficients of thermal expansion for common materials
b. Formulas for calculating:
    1. Linear expansion
    2. Area expansion (approx.)
    3. Volume expansion (approx.)
c. Density of water as a function of temperature

Provide Demonstration On:

Change of shape of bimetallic strips

Provide Practical Application On:

Calculating thermal expansion

INSTRUCTIONAL MATERIALS

Textbooks:

a. Harris and Hemmerling, *Introductory Applied Principles*
b. Marcus and Thrower, *Introduction to Applied Physics*
c. Pollack, *Applied Physics*
d. Zebrowski, *Physics for the Technicians*

Tools and Equipment:

Calculator

LAB HOURS 6

CLASS HOURS 1

EVALUATION (TSIII-07)

Given tables of coefficients of expansion of materials and using formulas, the student will calculate (correctly within rounding error) the change in size of an object as a function of a change in temperature.

TASK

TSIII-08 Calculating heat transfer

PERFORMANCE OBJECTIVE

Calculate heat transfer.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. The laws of thermodynamics
b. Specific heat capacities of common solids and liquids
c. Heat of fusion and vaporization of common substances

Provide Demonstration On:

Calculating heat transfer

Provide Practical Application On:

Calculating heat transfer in isolated systems

INSTRUCTIONAL MATERIALS

Textbooks:

a. Harris and Hemmerling, *Introductory Applied Principles*
b. Marcus and Thrower, *Introduction to Applied Physics*
c. Pollack, *Applied Physics*
d. Zebrowski, *Physics for the Technicians*

Tools and Equipment:

Calculator

LAB HOURS 6
CLASS HOURS 2

EVALUATION (TSIII-08)

Given formulas and tables, the student will calculate (correct within rounding error) heat transfer in isolated systems involving common materials.

TASK

TSIII-09 Calculating thermodynamic coordinates of substances

PERFORMANCE OBJECTIVE

Calculate the thermodynamic coordinates of ideal gases.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Ideal gas
b. Boyle's law
c. Charles' law
d. Units of pressure
e. P.V.T. (pressure, volume, temperature) surfaces for ideal gases
f. Critical points for common substances
g. Triple point

Provide Demonstration On:

Calculating thermodynamic coordinates

Provide Practical Application On:

Calculating thermodynamic coordinates

INSTRUCTIONAL MATERIALS

Textbooks:

a. Harris and Hemmerling, Introductory Applied Principles
b. Marcus and Thrower, Introduction to Applied Physics
c. Pollack, Applied Physics
d. Zebrowski, Physics for the Technicians

Tools and Equipment:

Calculator

LAB HOURS	5
CLASS HOURS	2

EVALUATION (TSIII-09)

Given formulas or diagrams, the student will calculate (correct within rounding error) or find the required thermodynamic coordinate (volume, temperature, pressure) of an ideal gas subject to changing coordinates.

TASK

TSIII-10 Calculating work done by heat engines

PERFORMANCE OBJECTIVE

Calculating the work done by a heat engine.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Heat engines
b. Indicator diagrams
c. The carnot engine
d. The otto cycle

Provide Demonstration On:

Calculating the area in an indicator diagram

Provide Practical Application On:

Calculating work done by a heat engine

INSTRUCTIONAL MATERIALS

Textbooks:

a. Harris and Hemmerling, Introductory Applied Principles
b. Marcus and Thrower, Introduction to Applied Physics
c. Pollack, Applied Physics
d. Zebrowski, Physics for the Technicians

Tools and Equipment:

a. Drafting tools
b. Calculator

LAB HOURS	4
CLASS HOURS	2

EVALUATION (TSIII-10)

Given an indicator diagram, the student will calculate (correct within scale and rounding error) the work done by a heat engine.

SECTION IV

CURRICULUM STRUCTURE, EXIT POINTS & COURSE OUTLINE

SECTION IV

Section IV Content List

Introduction to the Curriculum Structure
Curriculum Structure
  Group
  Individualized
Introduction to Drafting/Design Technology Exit Points
Introduction to the Course Outline
Course Outline

Section III presented a sample organizational model for sequencing the instruction of program tasks. Based on that model, Section IV provides suggested methods of structuring the entire Drafting/Design Technology curriculum.

INTRODUCTION TO THE CURRICULUM STRUCTURE

A curriculum structure is developed by sequencing duties into a logical teaching plan. Two curriculum structures are presented in this section - group and individualized.

The individualized structure also lists the duty areas under major blocks, but does not include hours or quarters. Using the individualized approach, the student proceeds at his or her pace until each task is mastered.

In either type of structure, the duty areas and major blocks can be rearranged to meet local needs.

DRAFTING/DESIGN TECHNOLOGY
SUGGESTED CURRICULUM STRUCTURE*

Course	Class Hours	Lab Hours	Total Hours
Quarter I			
Theory of Shape Description I	14	194	208
Math I	52		52
Communication Skills	52		52
	118	194	312
Quarter II			
Theory of Shape Description II	17	191	208
Technical Science and Strength of Materials	14	38	52
Math II	52		52
	83	229	312
Quarter III			
Design Drafting I	14	194	208
Technical Science II	16	36	52
Math III	52		52
	82	230	312
Quarter IV			
Design Drafting II	44	164	208
Technical Writing	52		52
Consumer Education	52		52
	148	164	312
Quarter V			
Design Drafting III	136	124	260
Strength of Materials II	19	33	52
	155	157	312
Quarter VI			
Design Drafting IV	69	139	208
Technical Science III	14	38	52
Human Relations	52		52
	135	177	312

*This curriculum structure is designed to be used for group instruction.

DRAFTING/DESIGN TECHNOLOGY
SUGGESTED CURRICULUM STRUCTURE*

Orientation
    School Policies and Procedures
    Program Orientation and Safety
    Operation of Audiovisual Equipment
    Using the Learning Resource Center

Theory of Shape Description I
Math I
Communication Skills
Theory of Shape Description II
Technical Science and Strength of Materials
Math II
Design Drafting I
Technical Science II
Math III
Design Drafting II
Technical Writing
Consumer Education
Design Drafting III
Strength of Materials II
Design Drafting IV
Technical Science III
Human Relations

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*This curriculum structure is designed to be used for individualized instruction.

INTRODUCTION TO DRAFTING/DESIGN TECHNOLOGY
EXIT POINTS

The following diagrams illustrate points in the Drafting/Design Technology program where a student should have acquired competencies necessary for entry level employment.

Both the group and individualized exit point diagrams sequence the Drafting/Design Technology job classifications from least to most difficult. The group exit point diagram illustrates a lock-step process in which students proceed through an entire program at the same pace and exit at approximately the same point in time.

The individualized exit point diagram illustrates a self-paced progression through the Drafting/Design Technology program. This approach permits a student to complete any one or all tasks necessary for entry level employment.

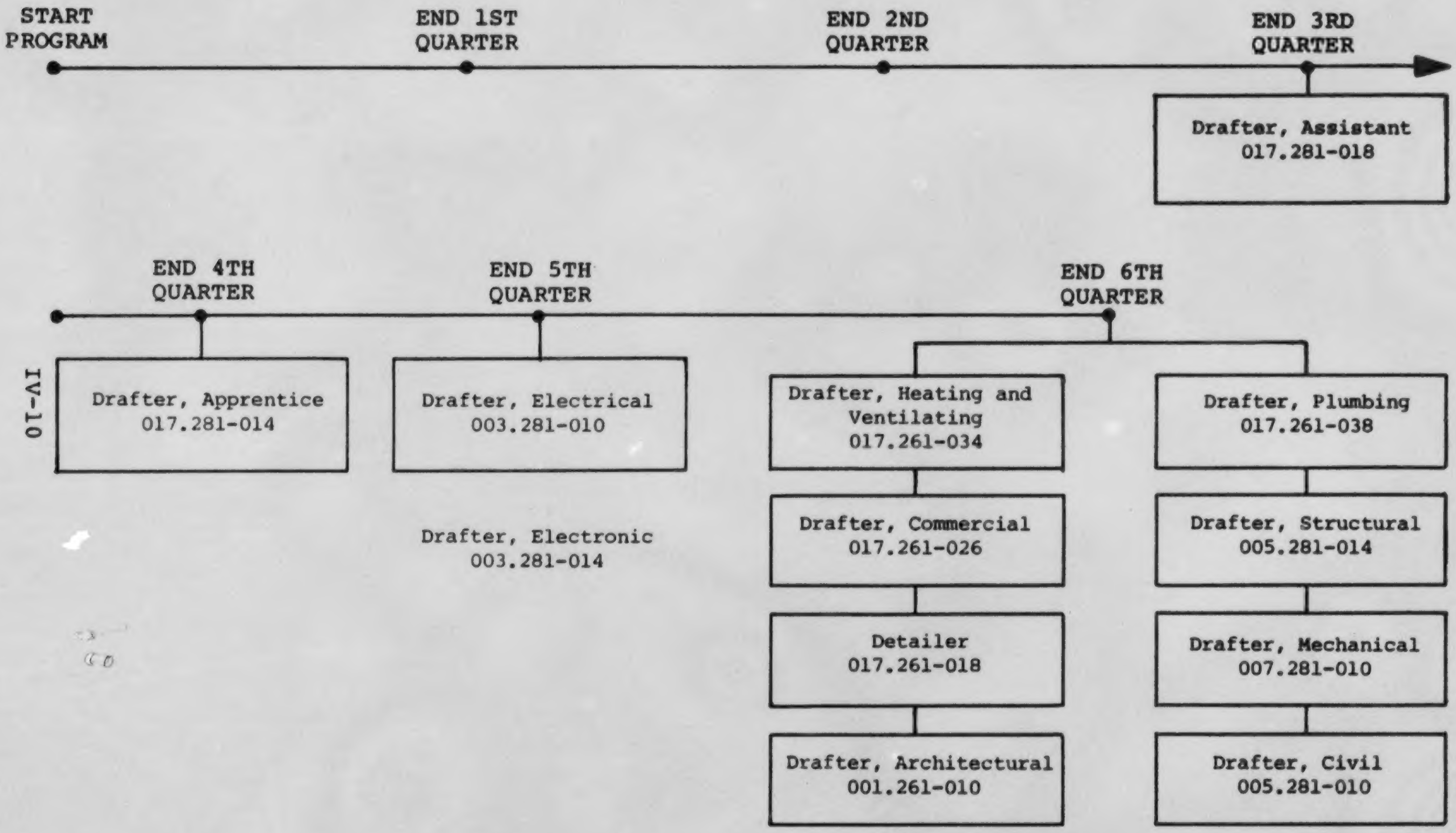
The major difference between the group and individualized approach is the number of tasks a student must master. For example, in the individualized approach, a student desiring employment as a Commercial Drafter needs to complete only those tasks identified for that job. However, in the group approach, a student must master the tasks in the previous DOT classifications leading to that particular job title.

The diagrams are based on the preceeding suggested curriculum structures.

DRAFTING/DESIGN TECHNOLOGY
(INDIVIDUALIZED INSTRUCTION)

Drafter, Assistant	017.281-018
Drafter, Apprentice	017.281-014
Drafter, Electrical	003.281-010
Drafter, Electronic	003.281-014
Drafter, Heating and Ventilating	017.261-034
Drafter, Plumbing	017.261-038
Drafter, Commercial	017.261-026
Drafter, Structural	005.281-014
Detailer	017.261-018
Drafter, Mechanical	007.281-010
Drafter, Architectural	001.261-010
Drafter, Civil	005.281-010

DRAFTING/DESIGN TECHNOLOGY
(GROUP INSTRUCTION)


START PROGRAM
END 1ST QUARTER
END 2ND QUARTER
END 3RD QUARTER
Drafter, Assistant 017.281-018
END 4TH QUARTER
END 5TH QUARTER
END 6TH QUARTER
Drafter, Apprentice 017.281-014
Drafter, Electrical 003.281-010
Drafter, Electronic 003.281-014
Drafter, Heating and Ventilating 017.261-034
Drafter, Commercial 017.261-026
Detailer 017.261-018
Drafter, Architectural 001.261-010
Drafter, Plumbing 017.261-038
Drafter, Structural 005.281-014
Drafter, Mechanical 007.281-010
Drafter, Civil 005.281-010

INTRODUCTION TO THE COURSE OUTLINE

A course outline suggests a method of sequencing tasks for instruction. In the following outline, the unit guide tasks are ordered according to duty areas. The tasks are then arranged from general to specific knowledge and applications. The instructor is not restricted to using this specific outline, but may adapt it to meet his or her teaching needs.

The following course outline is designed for group instruction, however, it may be adapted for individualized instruction by eliminating the time sequencing for tasks.

DRAFTING/DESIGN TECHNOLOGY
SUGGESTED COURSE OUTLINE

Quarter I

Task	Title	Class Hours	Lab Hours
	DUTY I: THEORY OF SHAPE DESCRIPTION I		
SDI-01	Hand lettering	2	18
SDI-02	Sketching freehand	2	18
SDI-03	Analyzing drawings for acceptable drafting practice	2	2
SDI-04	Drawing plane figures	2	38
SDI-05	Drawing with line contrast	1	1
SDI-06	Drawing to scale	1	1
SDI-07	Drawing in orthographic	2	48
SDI-08	Dimensioning	1	29
SDI-09	Drawing in isometric	1	39
		14	194

Total Quarter I Class and Lab Hours 14 194
Total Quarter I Related Instruction Hours 104
Total Quarter I Instructional Hours 312

Quarter II

Task	Title	Class Hours	Lab Hours
	DUTY II: THEORY OF SHAPE DESCRIPTION II		
SDII-01	Drawing auxiliary views	1	39
SDII-02	Drawing fundamental views	1	24
SDII-03	Connecting skew lines	1	14
SDII-04	Locating piercing points	1	7
SDII-05	Drawing plane intersections	2	10
SDII-06	Determining dihedral angle	1	7
SDII-07	Determining true length with revolution	1	7
SDII-08	Drawing intersecting solids	1	25
SDII-09	Drawing developments	2	28
SDII-10	Measuring distance	1	3
SDII-11	Measuring angles	1	7
SDII-12	Measuring elevations	1	3
SDII-13	Surveying polygonal areas	3	17
		17	191
	DUTY III: TECHNICAL SCIENCE AND STRENGTH OF MATERIALS		
TSSM-01	Transforming units	2	3
TSSM-02	Calculating resultant force	3	5
TSSM-03	Calculating forces in static systems	2	7
TSSM-04	Calculating stress	1	5
TSSM-05	Calculating strain	1	0
TSSM-06	Calculating deformation	1	4
TSSM-07	Calculating restoring force	1	4
TSSM-08	Designing area of materials under stress	1	5
TSSM-09	Calculating frictional forces	2	5
		14	38
	Total Quarter II Class and Lab Hours	31	229
	Total Quarter II Related Instruction Hours	52	
	Total Quarter II Instructional Hours	312	

Quarter III

Task	Title	Class Hours	Lab Hours
	DUTY IV: DESIGN DRAFTING I		
DDI-01	Drawing fasteners	1	11
DDI-02	Drawing welds	1	7
DDI-03	Dimensioning tolerances	1	7
DDI-04	Drawing gears	1	11
DDI-05	Drawing cams	1	11
DDI-06	Drawing details	2	28
DDI-07	Drawing assemblies	2	38
DDI-08	Drawing charts	1	19
DDI-09	Drawing graphs	1	19
DDI-10	Sketching designs	1	15
DDI-11	Drawing sections	2	28
		14	194
	DUTY V: TECHNICAL SCIENCE II		
TSII-01	Calculating mass	1	1
TSII-02	Describing motion in one dimension	2	5
TSII-03	Describing motion resulting from forces	2	5
TSII-04	Describing motion resulting from torques	2	5
TSII-05	Describing motion using momentum principles	2	5
TSII-06	Describing motion using energy principles	2	5
TSII-07	Calculating work	2	5
TSII-08	Calculating power	2	4
TSII-09	Calculating efficiency	1	1
		16	36
	Total Quarter III Class and Lab Hours	30	230

Total Quarter III Related Instruction Hours 52

Total Quarter III Instructional Hours 312

Quarter IV

Task	Title	Class Hours	Lab Hours
	DUTY VI: DESIGN DRAFTING II		
DDII-01	Lettering architecturally	2	8
DDII-02	Researching and analyzing accepted principles and methods of construction	5	15
DDII-03	Researching and interpreting the *Southern Standard Building Code*	10	0
DDII-04	Drawing with architectural expression	2	13
DDII-05	Aiding the architect in designing preliminary floor plans	2	18
DDII-06	Drawing finished floor plans	2	18
DDII-07	Drawing and reading small commercial survey plats	2	23
DDII-08	Drawing a small commercial building foundation plan	2	23
DDII-09	Drawing small commercial building elevations	2	23
DDII-10	Drawing light commercial building details	2	23
DDII-11	Aiding the architect in organizing and reproducing specifications for a small commercial building	13	0
		44	164

Total Quarter IV Class and Lab Hours 44 164
Total Quarter IV Related Instruction Hours 104
Total Quarter IV Instructional Hours 312

Quarter V

Task	Title	Class Hours	Lab Hours
	DUTY VII: DESIGN DRAFTING III		
DDIII-01	Defining terminology and analyzing theory	10	0
DDIII-02	Defining and converting electrical units associated with basic DC and AC circuits	10	0
DDIII-03	Calculating basic DC series circuits	10	0
DDIII-04	Calculating basic DC parallel circuits	10	0
DDIII-05	Calculating basic DC series parallel circuits	10	0
DDIII-06	Defining terminology and analyzing theory associated with basic AC circuits	10	0
DDIII-07	Calculating power factors, impedance and pure resistance in series AC circuits	10	0
DDIII-08	Calculating basic AC circuits with inductance reactance and resistance	10	0
DDIII-09	Calculating basic series AC circuits with capacitive reactance and resistance	10	0
DDIII-10	Calculating series AC circuits with capacitive and inductive reactance and resistance	10	0
DDIII-11	Calculating basic impedance in parallel AC circuits	10	0
DDIII-12	Applying basic AC circuit theory when drawing residential cable layouts	5	25
DDIII-13	Applying basic AC circuit theory when drawing commercial cable layouts	5	30
DDIII-14	Drawing electrical one-line diagrams	2	13
DDIII-15	Drawing electrical elementary diagrams	2	13
DDIII-16	Drawing electronic schematic diagrams	2	13
DDIII-17	Laying out, taping up and/or drawing basic printed circuit boards	10	30
		136	124
	DUTY VIII: STRENGTH OF MATERIALS II		
SMII-01	Calculating centroids of areas	2	3
SMII-02	Calculating moment of inertia of areas	3	2
SMII-03	Calculating shear and moment in simple beams	2	3
SMII-04	Calculating bending and shearing stresses in simple beams	2	3
SMII-05	Designing simple wood or steel beams of standard cross section	2	3
SMII-06	Calculating deflection of simple beams	1	4
SMII-07	Designing structural cross sections for statically indeterminate beams	1	4
SMII-08	Designing structural cross sections for simple steel and wood columns	2	3

Task	Title	Class Hours	Lab Hours
SMII-09	Calculating bending stress with tensile or compressive stress in beams and columns	2	3
SMII-10	Calculating torsional stresses in circular shafts	2	5
		19	33
	Total Quarter V Class and Lab Hours	155	157
	Total Quarter V Instructional Hours	312	

Quarter VI

Task	Title	Class Hours	Lab Hours
	DUTY IX: DESIGN DRAFTING IV		
DDIV-01	Analyzing the operation of gas and electric hot air heating and electric air cooling systems for residences and small commercial buildings	5	0
DDIV-02	Drawing heating, cooling and ventilating duct systems	1	14
DDIV-03	Drawing heating, cooling and ventilating system details	1	14
DDIV-04	Analyzing plumbing systems for residences and small commercial buildings	5	0
DDIV-05	Drawing water distribution and sanitary drainage systems for residences	1	14
DDIV-06	Drawing water distribution and sanitary drainage systems for small commercial buildings	1	14
DDIV-07	Researching data for drawing a process piping work drawing	5	0
DDIV-08	Drawing process piping flow diagrams using standard piping and instrumentation symbols	1	14
DDIV-09	Drawing isometric process piping diagrams using standard symbols	2	18
DDIV-10	Drawing orthographic process piping diagrams using standard symbols	2	18
DDIV-11	Describing the production and fabrication of structural steel	5	0
DDIV-12	Identifying and billing structural steel plain materials	5	0
DDIV-13	Researching specifications, grades and tolerances for structural steel	5	0
DDIV-14	Researching properties and detailing dimensions for structural steel	5	0
DDIV-15	Analyzing welding processes and researching welding symbols for structural steel	13	0
DDIV-16	Aiding the structural engineer in designing and drawing framed and seated beam connections (bolted and riveted)	5	10
DDIV-17	Aiding the structural engineer in designing and drawing welded framed and seated beam connections	5	10
DDIV-18	Drawing structural steel column details	2	13
		69	139
	DUTY X: TECHNICAL SCIENCE III		
TSIII-01	Calculating fluid pressure	1	3
TSIII-02	Calculating fluid velocity	1	2

Task	Title	Class Hours	Lab Hours
TSIII-03	Calculating buoyant force	1	3
TSIII-04	Describing vibrating systems	2	5
TSIII-05	Defining the structure of matter	1	3
TSIII-06	Changing units of temperature	1	1
TSIII-07	Calculating thermal expansion	1	6
TSIII-08	Calculating heat transfer	2	6
TSIII-09	Calculating thermodynamic coordinates of substances	2	5
TSIII-10	Calculating work done by heat engines	2	4
		14	38
	Total Quarter VI Class and Lab Hours	83	177
	Total Quarter VI Related Instruction Hours	52	
	Total Quarter VI Instructional Hours	312	
	Total Program Hours	1,872	

SECTION V

RECORDS

SECTION V

Section V Content List

Individualized Competency Record
Group Progress Chart

Section V presents suggested ways of recording and documenting the progress of students through the curriculum. The recommended procedures include options for both individual and group records. The very important function of communicating the student's qualifications to potential employers is handled clearly and efficiently by the use of the Certificate of Competency, which is also described in this section.

RECORDS MANAGEMENT

This guide provides a series of easy to use documents that will aid the instructor in recordkeeping and that will be beneficial to the student in entering the work force.

In addition to providing the instructor with an "at a glance" assessment of individual and/or group progress, a Certificate of Competency, which can be used by students seeking employment, is included.

The group progress chart reflects individual task completion of all students. Due to confidentiality of records, grades must not be recorded on the chart. A notation indicating task completion (i.e., x or check) should be used.

INSTRUCTIONS

Instructions

Competency Checklist

1) Enter the student's name.
2) Enter the date and instructor's initials as each unit of instruction is completed.

The Competency Checklist automatically indicates when all the requirements for each DOT exit point or job title have been completed by the student. At each point on the certificate where an asterisk appears, the student is eligible to receive a Certificate of Competency.

Certificate of Competency

A Certificate of Competency is to be issued for each job title for which a student is qualified.

1) Enter the student's name.
2) Enter the school's name
3) Sign and date the form.

A Certificate of Competency may be issued at the time a student qualifies for it, or all certificates for which a student qualifies may be issued to the student when he/she completes or leaves the program.

Group Progress Chart

1) Enter all program tasks across top of matrix.
2) Enter the students' names down the left hand side of matrix.
3) As each student completes a task, a notation should be made in the square which corresponds with the task and the student's name.

COMPETENCY CHECKLIST

PROGRAM: DRAFTING/DESIGN TECHNOLOGY

STUDENT NAME: ______________________

EXIT POINTS

TASK NO.	UNIT COMPETENCIES	DATE	IN'T.	DOT NO. 017.281-018 JOB TITLE Drafter, Assistant	017.281-014 Drafter, Apprentice	003.281-010 Drafter, Electrical	033.281-014 Drafter, Electronic	017.261-034 Drafter, Heating and Ventilating	017.261-038 Drafter, Plumbing	017.261-026 Drafter, Commercial	005.281-014 Drafter, Structural	017.261-018 Detailer	007.281-010 Drafter, Mechanical	001.261-010 Drafter, Architectural	005.281-010 Drafter, Civil
	Theory of Shape Description														
SDI-01	Hand lettering			X	X	X	X	X	X	X	X	X	X	X	X
SDI-02	Sketching freehand			X	X	X	X	X	X	X	X	X	X	X	X
SDI-03	Analyzing drawings for acceptable drafting practice			X	X	X	X	X	X	X	X	X	X	X	X
SDI-04	Drawing plane figures			X	X	X	X	X	X	X	X	X	X	X	X
SDI-05	Drawing with line contrast			X	X	X	X	X	X	X	X	X	X	X	X
SDI-06	Drawing to scale			X	X	X	X	X	X	X	X	X	X	X	X
SDI-07	Drawing in orthographic			X	X	X	X	X	X	X	X	X	X	X	X
SDI-08	Dimensioning			X	X	X	X	X	X	X	X	X	X	X	X
SDI-09	Drawing in isometric			X	X	X	X	X	X	X	X	X	X	X	X
	Theory of Shape Description II														
SDII-01	Drawing auxiliary views			X	X							X	X	X	X
SDII-02	Drawing fundamental views			X	X							X	X	X	X
SDII-03	Connecting skew lines			X	X							X	X	X	X
SDII-04	Locating piercing points			X	X							X	X	X	X
SDII-05	Drawing plane intersections			X	X							X	X	X	X
SDII-06	Determining dihedral angle			X	X							X	X	X	X
SDII-07	Determining true length with revolution			X	X							X	X	X	X
SDII-08	Drawing intersecting solids			X	X							X	X	X	X
SDII-09	Drawing developments			X	X							X	X		
SDII-10	Measuring distance													X	X
SDII-11	Measuring angles													X	X
SDII-12	Measuring elevations													X	X
SDII-13	Surveying polygonal areas													X	X
	Technical Science and Strength of Materials														
TSSM-01	Transforming units											X	X	X	X
TSSM-02	Calculating resultant force											X	X	X	X
TSSM-03	Calculating forces in static systems											X	X	X	X
TSSM-04	Calculating stress											X	X	X	X
TSSM-05	Calculating strain											X	X	X	X
TSSM-06	Calculating deformation											X	X	X	X
TSSM-07	Calculating restoring force											X	X	X	X
TSSM-08	Designing area of materials under stress											X	X	X	X
TSSM-09	Calculating frictional forces											X	X	X	X
	Design Drafting I														
DDI-01	Drawing fasteners			X	X							X	X	X	X
DDI-02	Drawing welds			X	X							X	X	X	X
DDI-03	Dimensioning tolerances			X	X							X	X	X	X
DDI-04	Drawing gears			X	X							X	X	X	
DDI-05	Drawing cams			X	X							X	X	X	
DDI-06	Drawing details			X	X							X	X	X	X

COMPETENCY CHECKLIST

EXIT POINTS

PROGRAM: DRAFTING/DESIGN TECHNOLOGY

STUDENT NAME: ______________________________

TASK NO.	UNIT COMPETENCIES	DATE	IN'T.	DOT NO. 017.281-018 JOB TITLE Drafter, Assistant	017.281-014 Drafter, Apprentice	003.281-010 Drafter, Electrical	033.281-014 Drafter, Electronic	017.261-034 Drafter, Heating and Ventilating	017.261-038 Drafter, Plumbing	017.261-026 Drafter, Commercial	005.281-014 Drafter, Structural	017.261-018 Detailer	007.281-010 Drafter, Mechanical	001.261-010 Drafter, Architectural	005.281-010 Drafter, Civil
DDI-07	Drawing assemblies			X	X							X	X	X	X
DDI-08	Drawing charts			X	X							X	X	X	X
DDI-09	Drawing graphs			X	X							X	X	X	X
DDI-10	Sketching designs			X	X							X	X	X	X
DDI-11	Drawing sections			X*	X							X	X	X	X
	Technical Science II														
TSII-01	Calculating mass											X	X	X	X
TSII-02	Describing motion in one dimension											X	X	X	X
TSII-03	Describing motion resulting from forces											X	X	X	X
TSII-04	Describing motion resulting from torques											X	X	X	X
TSII-05	Describing motion using momentum principles											X	X	X	X
TSII-06	Describing motion using energy principles											X	X	X	X
TSII-07	Calculating work											X	X	X	X
TSII-08	Calculating power											X	X	X	X
TSII-09	Calculating efficiency											X	X	X	X
	Design Drafting II														
DDII-01	Lettering architecturally				X					X				X	X
DDII-02	Researching and analyzing accepted principles and methods of construction									X				X	
DDII-03	Researching and interpreting the Southern Standard Building Code									X				X	X
DDII-04	Drawing with architectural expression				X					X				X	
DDII-05	Aiding the architect in designing preliminary floor plans									X				X	
DDII-06	Drawing finished floor plans									X				X	
DDII-07	Drawing and reading small commercial survey plats									X				X	X
DDII-08	Drawing a small commercial building foundation plan									X				X	X
DDII-09	Drawing small commercial building elevations									X				X	
DDII-10	Drawing light commercial building details									X				X	
DDII-11	Aiding the architect in organizing and reproducing specifications for a small commercial building				X*					X				X	
	Design Drafting III														
DDIII-01	Defining terminology and analyzing theory associated with basic DC circuits					X	X								
DDIII-02	Defining and converting electrical units associated with basic DC and AC circuits					X	X								
DDIII-03	Calculating basic DC series circuits					X	X								

COMPETENCY CHECKLIST

PROGRAM: DRAFTING/DESIGN TECHNOLOGY

STUDENT NAME:__________________________

EXIT POINTS

TASK NO.	UNIT COMPETENCIES	DATE	IN'T.	DOT NO. 017.281-018 JOB TITLE Drafter, Assistant	017.281-014 Drafter, Apprentice	003.281-010 Drafter, Electrical	033.281-014 Drafter, Electronic	017.261-034 Drafter, Heating and Ventilating	017.261-038 Drafter, Plumbing	017.261-026 Drafter, Commercial	005.281-014 Drafter, Structural	017.261-018 Detailer	007.281-010 Drafter, Mechanical	001.261-010 Drafter, Architectural	005.281-010 Drafter, Civil
DDII-04	Calculating basic DC parallel circuits					X	X								
DDII-05	Calculating basic DC series parallel circuits					X	X								
DDII-06	Defining terminology and analyzing theory associated with basic AC circuits					X	X								
DDII-07	Calculating power factors, impedance and pure resistance in series AC circuits					X	X								
DDII-08	Calculating basic AC circuits with inductance reactance and resistance					X	X								
DDII-09	Calculating basic series AC circuits with capacitive reactance and resistance					X	X								
DDII-10	Calculating series AC circuits with capacitive and inductive reactance and resistance					X	X								
DDII-11	Calculating basic impedance in parallel AC circuits					X	X								
DDII-12	Applying basic AC circuit theory when drawing residential cable layouts					X									
DDII-13	Applying basic AC circuit theory when drawing commercial cable layouts					X									
DDII-14	Drawing electrical one-line diagrams					X									
DDII-15	Drawing electrical elementary diagrams					X*									
DDII-16	Drawing electronic schematic diagrams						X								
DDII-17	Laying out, taping up and/or drawing basic printed circuit boards						X*								
	Strength of Materials II														
SMII-01	Calculating centroids of areas										X	X		X	
SMII-02	Calculating moment of inertia of areas										X	X		X	
SMII-03	Calculating shear and moment in simple beams										X	X		X	
SMII-04	Calculating bending and shearing stresses in simple beams										X	X		X	
SMII-05	Designing simple wood or steel beams of standard cross section										X	X		X	
SMII-06	Calculating deflection of simple beams										X	X		X	
SMII-07	Designing structural cross sections for statically indeterminate beams										X	X		X	
SMII-08	Designing structural cross sections for simple steel and wood columns										X	X		X	
SMII-09	Calculating bending stress with tensile or compressive stress in beams and columns										X	X		X	
SMII-10	Calculating torsional stresses in circular shafts										X	X			

COMPETENCY CHECKLIST

PROGRAM: DRAFTING/DESIGN TECHNOLOGY

STUDENT NAME: ____________________

EXIT POINTS

TASK NO.	UNIT COMPETENCIES	DATE	IN'T.	DOT NO. 017.281-018 JOB TITLE Drafter, Assistant	017.281-014 Drafter, Apprentice	003.281-010 Drafter, Electrical	003.281-014 Drafter, Electronic	017.261-034 Drafter, Heating and Ventilating	017.261-038 Drafter, Plumbing	017.261-026 Drafter, Commercial	005.281-014 Drafter, Structural	017.261-018 Detailer	007.281-010 Drafter, Mechanical	001.261-010 Drafter, Architectural	005.281-010 Drafter, Civil
	Design Drafting IV														
DDIV-01	Analyzing the operation of gas and electric hot air heating and electric air cooling systems for residences and small commercial buildings							X		X				X	
DDIV-02	Drawing heating, cooling and ventilating duct systems							X		X				X	
DDIV-03	Drawing heating, cooling and ventilating system details							X		X				X	
DDIV-04	Analyzing plumbing systems for residences and small commercial buildings								X	X					
DDIV-05	Drawing water distribution and sanitary drainage systems for residences							X*		X				X	
DDIV-06	Drawing water distribution and sanitary drainage systems for small commercial buildings								X	X*				X	
DDIV-07	Researching data for drawing a process piping working drawing								X						
DDIV-08	Drawing process piping flow diagrams using standard piping and instrumentation symbols								X						
DDIV-09	Drawing isometric process piping diagrams using standard symbols								X						
DDIV-10	Drawing orthographic process piping drawings using standard symbols								X*						
DDIV-11	Describing the production and fabrication of structural steel										X	X			
DDIV-12	Identifying and billing structural steel plain materials										X	X			
DDIV-13	Researching specifications, grades and tolerances for structural steel										X	X			
DDIV-14	Researching properties and detailing dimensions for structural steel										X	X			
DDIV-15	Analyzing welding processes and researching welding symbols for structural steel										X	X			
DDIV-16	Aiding the structural engineer in designing and drawing framed and seated beam connections (bolted and riveted)										X	X			
DDIV-17	Aiding the structural engineer in designing and drawing welded framed and seated beam connections										X	X			
DDIV-18	Drawing structural steel column details										X*	X			
	Technical Science III														
TSIII-01	Calculating fluid pressure											X	X	X	X

COMPETENCY CHECKLIST

PROGRAM: DRAFTING/DESIGN TECHNOLOGY

STUDENT NAME: ____________________

				EXIT POINTS											
TASK NO.	UNIT COMPETENCIES	DATE	IN'T.	DOT NO. 017.281-018 JOB TITLE Drafter, Assistant	017.281-014 Drafter, Apprentice	003.281-010 Drafter, Electrical	033.281-014 Drafter, Electronic	017.261-034 Drafter, Heating and Ventilating	017.261-038 Drafter, Plumbing	017.261-026 Drafter, Commercial	005.281-014 Drafter, Structural	017.261-018 Detailer	007.281-010 Drafter, Mechanical	001.261-010 Drafter, Architectural	005.281-010 Drafter, Civil
TSIII-02	Calculating fluid velocity											X	X	X	X
TSIII-03	Calculating buoyant force											X	X	X	X
TSIII-04	Describing vibrating systems											X	X	X	X
TSIII-05	Defining the structure of matter											X	X	X	X
TSIII-06	Changing units of temperature											X	X	X	X
TSIII-07	Calculating thermal expansion											X	X	X	X
TSIII-08	Calculating heat transfer											X	X	X	X
TSIII-09	Calculating thermodynamic coordinates of substances											X	X	X	X
TSIII-10	Calculating work done by heat engines											X*	X*	X*	X*

This is to certify that the above named student has demonstrated proficiency in the performance of the competencies and/or tasks indicated above. These competencies and/or tasks have been determined to be the skills and knowledge that are necessary for entry level employment into the job classifications indicated.

Date__________________ Instructor______________
School______________
Instructor______________
Instructor______________
Instructor______________
Instructor______________

*Certificate of Competency can be issued

CERTIFICATE OF COMPETENCY

This is to Certify that

Geraldine Marie Parker

of

Augusta Area Technical School

has successfully mastered the competencies required to perform the job of

STRUCTURAL DRAFTER

George W. Bragg Jr.

June 5, 1982

V-13

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The student named on this certificate has demonstrated mastery of the following unit level competencies required to perform the job of Drafter, Structural.

DRAFTER, STRUCTURAL
(D.O.T. Code 005.281-014)

Theory of Shape Description

Hand lettering
Sketching freehand
Analyzing drawings for acceptable drafting practice
Drawing plane figures
Drawing with line contrast
Drawing to scale
Drawing in orthographic
Dimensioning
Drawing in isometric

Strength of Materials II

Calculating centroids of areas
Calculating moment of inertia of areas
Calculating shear and moment in simple beams
Calculating bending and shearing stresses in simple beams
Designing simple wood or steel beams of standard cross section
Calculating deflection of simple beams
Designing structural cross sections for statically indeterminate beams
Designing structural cross sections for steel and wood columns
Calculating bending stress with tensile or compressive stress in beams and columns
Calculating torsional stresses in circular shafts

Design Drafting IV

Describing the production and fabrication of structural steel
Identifying and billing structural steel plain materials
Researching specifications, grades and tolerances for structural steel
Researching properties and detailing dimensions for structural steel
Analyzing welding processes and researching welding symbols for structural steel
Aiding the structural engineer in designing and drawing framed and seated beam connections (bolted and riveted)
Aiding the structural engineer in designing and drawing welded framed and seated beam connections
Drawing structural steel column details

CERTIFICATE OF COMPETENCY

This is to Certify that

of

has successfully mastered the competencies required to perform the job of

DRAFTER, ASSISTANT

The student named on this certificate has demonstrated mastery of the following unit level competencies required to perform the job of Drafter, Assistant.

DRAFTER, ASSISTANT
(D.O.T. Code 017.281-018)

Theory of Shape Description
Hand lettering
Sketching freehand
Analyzing drawings for acceptable drafting practice
Drawing plane figures
Drawing with line contrast
Drawing to scale
Drawing in orthographic
Dimensioning
Drawing in isometric

Theory of Shape Description II
Drawing auxilary views
Drawing fundamental views
Connecting skew lines
Locating piercing points
Drawing plane intersections
Determining true length with revolution
Drawing intersection solids
Drawing developments
Measuring distance

Design Drafting I
Drawing fasteners
Drawing welds
Dimensioning tolerances
Drawing gears
Drawing cams
Drawing details
Drawing assemblies
Drawing charts
Drawing graphs
Sketching designs
Drawing sections

CERTIFICATE OF COMPETENCY

This is to Certify that

of

has successfully mastered the competencies required to perform the job of

DRAFTER, APPRENTICE

The student named on this certificate has demonstrated mastery of the following unit level competencies required to perform the job of Drafter, Apprentice.

DRAFTER, APPRENTICE
(D.O.T. Code 017.281-014)

Theory of Shape Description
- Hand lettering
- Sketching freehand
- Analyzing drawings for acceptable drafting practice
- Drawing plane figures
- Drawing with line contrast
- Drawing to scale
- Drawing in orthographic
- Dimensioning
- Drawing in isometric

Theory of Shape Description II
- Drawing auxilary views
- Drawing fundamental views
- Connecting skew lines
- Locating piercing points
- Drawing plane intersections
- Determining true length with revolution
- Drawing intersection solids
- Drawing developments
- Measuring distance

Design Drafting I
- Drawing fasteners
- Drawing welds
- Dimensioning tolerances
- Drawing gears
- Drawing cams
- Drawing details
- Drawing assemblies
- Drawing charts
- Drawing graphs
- Sketching designs
- Drawing sections

Design Drafting II
- Lettering architecturally
- Drawing with architectural expression
- Aiding the architect in organizing and reproducing specifications for a small commercial building

V-19

CERTIFICATE OF COMPETENCY

This is to Certify that

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of

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has successfully mastered the competencies required to perform the job of

DRAFTER, ELECTRICAL

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The student named on this certificate has demonstrated mastery of the following unit level competencies required to perform the job of Drafter, Electrical.

DRAFTER, ELECTRICAL
(D.O.T. Code 003.281-010)

Theory of Shape Description

Hand lettering
Sketching freehand
Analyzing drawings for acceptable drafting practice
Drawing plane figures
Drawing with line contrast
Drawing to scale
Drawing in orthographic
Dimensioning
Drawing in isometric

Design Drafting III

Defining terminology and analyzing theory associated with basic DC circuits
Defining and converting electrical units associated with basic DC and AC circuits
Calculating basic DC series circuits
Calculating basic DC parallel circuits
Calculating basic DC series parallel circuits
Defining terminology and analyzing theory associated with basic AC circuits
Calculating power factors, impedance and pure resistance in series AC circuits
Calculating basic AC circuits with inductance reactance and resistance
Calculating basic series AC circuits with capacitive reactance and resistance
Calculating series AC circuits with capacitive and inductive reactance and resistance
Calculating basic impedance in parallel AC circuits
Applying basic AC circuit theory when drawing residential cable layouts
Applying basic AC circuit theory when drawing commercial cable layouts
Drawing electrical one-line diagrams
Drawing electrical elementary diagrams

CERTIFICATE OF COMPETENCY

This is to Certify that

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of

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has successfully mastered the competencies required to perform the job of

DRAFTER, ELECTRONIC

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The student named on this certificate has demonstrated mastery of the following unit level competencies required to perform the job of Drafter, Electronic.

DRAFTER, ELECTRONIC
(D.O.T. Code 003.281-014)

Theory of Shape Description
Hand lettering
Sketching freehand
Analyzing drawings for acceptable drafting practice
Drawing plane figures
Drawing with line contrast
Drawing to scale
Drawing in orthographic
Dimensioning
Drawing in isometric

Design Drafting III
Defining terminology and analyzing theory associated with basic DC circuits
Defining and converting electrical units associated with basic DC and AC circuits
Calculating basic DC series circuits
Calculating basic DC parallel circuits
Calculating basic DC series parallel circuits
Defining terminology and analyzing theory associated with basic AC circuits
Calculating power factors, impedance and pure resistance in series AC circuits
Calculating basic AC circuits with inductance reactance and resistance
Calculating basic series AC circuits with capacitive reactance and resistance
Calculating series AC circuits with capacitive and inductive reactance and resistance
Calculating basic impedance in parallel AC circuits
Drawing electronic schematic diagrams
Laying out, taping up and/or drawing basic printed circuit boards

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CERTIFICATE OF COMPETENCY

This is to Certify that

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of

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has successfully mastered the competencies required to perform the job of

DRAFTER, HEATING AND VENTILATING

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The student named on this certificate has demonstrated mastery of the following unit level competencies required to perform the job of Drafter, Heating and Ventilating.

DRAFTER, HEATING AND VENTILATING
(D.O.T. Code 017.261-034)

Theory of Shape Description

Hand lettering
Sketching freehand
Analyzing drawings for acceptable drafting practice
Drawing plane figures
Drawing with line contrast
Drawing to scale
Drawing in orthographic
Dimensioning
Drawing in isometric

Design Drafting IV

Analyzing the operation of gas and electric hot air heating and electric air cooling systems for residences and small commercial buildings
Drawing heating, cooling and ventilating duct systems
Drawing heating, cooling and ventialting system details
Drawing water distribution and sanitary drainage systems for residences

CERTIFICATE OF COMPETENCY

This is to Certify that

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of

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has successfully mastered the competencies required to perform the job of

DRAFTER, PLUMBING
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V-25

The student named on this certificate has demonstrated mastery of the following unit level competencies required to perform the job of Drafter, Plumbing.

DRAFTER, PLUMBING

(D.O.T. Code 017.261-038)

Theory of Shape Description

Hand lettering
Sketching freehand
Analyzing drawings for acceptable drafting practice
Drawing plane figures
Drawing with line contrast
Drawing to scale
Drawing in orthographic
Dimensioning
Drawing in isometric

Design Drafting IV

Analyzing plumbing systems for residences and small commercial buildings
Drawing water distribution and sanitary draining systems for small commercial buildings
Researching data for drawing a process piping working drawing
Drawing process piping flow diagrams using standard piping and instrumentation symbols
Drawing isometric process piping diagrams using standard symbols
Drawing orthographic process piping drawings using standard symbols

CERTIFICATE OF COMPETENCY

This is to Certify that

of

has successfully mastered the competencies required to perform the job of

DRAFTER, COMMERCIAL

V-27

The student named on this certificate has demonstrated mastery of the following unit level competencies required to perform the job of Drafter, Commercial.

DRAFTER, COMMERCIAL
(D.O.T. Code 017.261-026)

Theory of Shape Description

- Hand lettering
- Sketching freehand
- Analyzing drawings for acceptable drafting practice
- Drawing plane figures
- Drawing with line contrast
- Drawing to scale
- Drawing in orthographic
- Dimensioning
- Drawing in isometric

Design Drafting II

- Lettering architecturally
- Researching and analyzing accepted principles and methods of construction
- Researching and interpreting the Southern Standard Building Code
- Drawing with architectural expression
- Aiding the architect in designing preliminary floor plans
- Drawing finished floor plans
- Drawing and reading samll commercial survey plots
- Drawing a small commercial building foundation plan
- Drawing small commercial building elevations
- Drawing light commercial building details
- Aiding the architect in organizing and reproducing specifications for a small commercial building

Design Drafting III

- Defining terminology and analyzing theory associated with basic DC circuits
- Defining and converting electrical units associated with basic DC and AC circuits
- Calculating basic DC series circuits

Design Drafting IV

- Analyzing the operation of gas and electric hot air heating and electric air cooling systems for residences and small commercial buildings
- Drawing heating, cooling and ventilating duct systems
- Drawing heating, cooling and ventilating system details
- Analyzing plumbing systems for residences and small commercial buildings
- Drawing water distribution and sanitary drainage systems for residences
- Drawing water distribution and sanitary draining systems for small commercial buildings
- Researching data for drawing a process piping working drawing
- Drawing process piping flow diagrams using standard piping and instrumentation symbols
- Drawing isometric process piping diagrams using standard symbols
- Drawing orthographic process piping drawings using standard symbols

CERTIFICATE OF COMPETENCY

This is to Certify that

of

has successfully mastered the competencies required to perform the job of

DRAFTER, STRUCTURAL

The student named on this certificate has demonstrated mastery of the following unit level competencies required to perform the job of Drafter, Structural.

DRAFTER, STRUCTURAL
(D.O.T. Code 005.281-014)

Theory of Shape Description
- Hand lettering
- Sketching freehand
- Analyzing drawings for acceptable drafting practice
- Drawing plane figures
- Drawing with line contrast
- Drawing to scale
- Drawing in orthographic
- Dimensioning
- Drawing in isometric

Strength of Materials II
- Calculating centroids of areas
- Calculating moment of inertia of areas
- Calculating shear and moment in simple beams
- Calculating bending and shearing stresses in simple beams
- Designing simple wood or steel beams of standard cross section
- Calculating deflection of simple beams
- Designing structural cross sections for statically indeterminate beams
- Designing structural cross sections for steel and wood columns
- Calculating bending stress with tensile or compressive stress in beams and columns
- Calculating torsional stresses in circular shafts

Design Drafting IV
- Describing the production and fabrication of structural steel
- Identifying and billing structural steel plain materials
- Researching specifications, grades and tolerances for structural steel
- Researching properties and detailing dimensions for structural steel
- Analyzing welding processes and researching welding symbols for structural steel
- Aiding the structural engineer in designing and drawing framed and seated beam connections (bolted and riveted)
- Aiding the structural engineer in designing and drawing welded framed and seated beam connections
- Drawing structural steel column details

CERTIFICATE OF COMPETENCY

This is to Certify that

of

has successfully mastered the competencies required to perform the job of

DETAILER

The student named on this certificate has demonstrated mastery of the following unit level competencies required to perform the job of Detailer.

DETAILER
(D.O.T. Code 017.261-026)

Theory of Shape Description
Hand lettering
Sketching freehand
Analyzing drawings for acceptable drafting practice
Drawing plane figures
Drawing with line contrast
Drawing to scale
Drawing in orthographic
Dimensioning
Drawing in isometric

Theory of Shape Description II
Drawing auxiliary views
Drawing fundamental views
Connecting skew lines
Locating piercing points
Drawing plane intersections
Determining dihedral angle
Determining true length with revolution
Drawing intersecting solids
Drawing developments
Measuring distance

Technical Science and Strength of Materials
Transforming units
Calculating resultant force
Calculating forces in static system
Calculating stress
Calculating strain
Calculating deformation
Calculating restoring force
Designing area of materials under stress
Calculating frictional forces

Design Drafting I
Drawing fasteners
Drawing welds
Dimensioning tolerances
Drawing gears
Drawing cams
Drawing details
Drawing assemblies
Drawing charts
Drawing graphs
Sketching designs
Drawing sections

Technical Science II
Calculating mass
Describing motion in one dimension
Describing motion resulting from forces
Describing motion resulting from torques
Describing motion using momentum principles
Describing motion using energy principles
Calculating work
Calculating power
Calculating efficiency

Strength of Materials II
Calculating centroids of areas
Calculating moment of inertia of areas
Calculating shear and moment in simple beams
Calculating bending and shearing stresses in simple beams
Designing simple wood or steel beams of standard cross section
Calculating deflection of simple beams
Designing structural cross sections for statically indeterminate beams
Designing structural cross sections for steel and wood columns
Calculating bending stress with tensile or compressive stress in beams and columns
Calculating torsional stresses in circular shafts

Design Drafting IV
Describing the production and fabrication of structural steel
Identifying and billing structural steel plain materials
Researching specifications, grades and tolerances for structural steel
Researching properties and detailing dimensions for structural steel
Analyzing welding processes and researching welding symbols for structural steel
Aiding the structural engineer in designing and drawing framed and seated beam connections (bolted and riveted)
Aiding the structural engineer in designing and drawing welded framed and seated beam connections
Drawing structural steel column details

Technical Science III
Calculating fluid pressure
Calculating fluid velocity
Calculating buoyant force
Describing vibrating systems
Defining the structure of matter
Changing units of temperature
Calculating thermal expansion
Calculating heat transfer
Calculating thermodynamic coordinates of substances
Calculating work done by heat engines

CERTIFICATE OF COMPETENCY

This is to Certify that

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of

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has successfully mastered the competencies required to perform the job of

DRAFTER, MECHANICAL

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The student named on this certificate has demonstrated mastery of the following unit level competencies required to perform the job of Drafter, Mechanical.

DRAFTER, MECHANICAL
(D.O.T. Code 007.281-010)

Theory of Shape Description
- Hand lettering
- Sketching freehand
- Analyzing drawings for acceptable drafting practice
- Drawing plane figures
- Drawing with line contrast
- Drawing to scale
- Drawing in orthographic
- Dimensioning
- Drawing in isometric

Theory of Shape Description II
- Drawing auxiliary views
- Drawing fundamental views
- Connecting skew lines
- Locating piercing points
- Drawing plane intersections
- Determining dihedral angle
- Determining true length with revolution
- Drawing intersection solids
- Drawing developments

Technical Science and Strength of Materials
- Transforming units
- Calculating resultant force
- Calculating forces in static systems
- Calculating stress
- Calculating strain
- Calculating deformation
- Calculating restoring force
- Designing area of materials under stress
- Calculating frictional forces

Design Drafting I
- Drawing fasteners
- Drawing welds
- Dimensioning tolerances
- Drawing gears
- Drawing cams
- Drawing details
- Drawing assemblies
- Drawing charts
- Drawing graphs
- Sketching designs
- Drawing sections

Technical Science II
- Calculating mass
- Describing motion in one dimension
- Describing motion resulting from forces
- Describing motion resulting from torques
- Describing motion using momentum principles
- Describing motion using energy principles
- Calculating work
- Calculating power
- Calculating efficiency

Technical Science III
- Calculating fluid pressure
- Calculating fluid velocity
- Calculating buoyant force
- Describing vibrating systems
- Defining the structure of matter
- Changing units of temperature
- Calculating thermal expansion
- Calculating heat transfer
- Calculating thermodynamic coordinates of substances
- Calculating work done by heat engines

CERTIFICATE OF COMPETENCY

This is to Certify that

of

has successfully mastered the competencies required to perform the job of

DRAFTER, ARCHITECTURAL

The student named on this certificate has demonstrated mastery of the following unit level competencies required to perform the job of Drafter, Architectural.

DRAFTER, ARCHITECTURAL
(D.O.T. Code 001.261-010)

Theory of Shape Description
Hand lettering
Sketching freehand
Analyzing drawings for acceptable drafting practice
Drawing plane figures
Drawing with line contrast
Drawing to scale
Drawing in orthographic
Dimensioning
Drawing in isometric

Theory of Shape Description II
Drawing auxiliary views
Drawing fundamental views
Connecting skew lines
Locating piercing points
Drawing plane intersections
Determining dihedral angle
Determining true length with revolution
Drawing intersecting solids
Drawing developments
Measuring distance
Measuring angles
Measuring elevations
Surveying polygonal areas

Technical Science and Strength of Materials
Transforming units
Calculating resultant force
Calculating forces in static systems
Calculating stress
Calculating strain
Calculating deformation
Calculating restoring force
Designing area of materials under stress
Calculating frictional forces

Design Drafting I
Drawing fasteners
Drawing welds
Dimensioning tolerances
Drawing gears
Drawing cams
Drawing details
Drawing assemblies
Drawing charts
Drawing graphs
Sketching designs
Drawing sections

Technical Science II
Calculating mass
Describing motion in one dimension
Describing motion resulting from forces
Describing motion resulting from torques
Describing motion using momemtum principles
Describing motion using energy principles
Calculating work
Calculating power
Calculating efficiency

Design Drafting II
Lettering architecturally
Researching and analyzing accepted principles and methods of construction
Researching and interpreting the Southern Standard Building Code
Drawing with architectural expression
Aiding the architect in designing preliminary floor plans
Drawing finished floor plans
Drawing and reading small commercial survey plats
Drawing a small commercial building foundation plan
Drawing small commercial building elevations printed circuit board

Strength of Materials II
Calculating centroids of areas
Calculating moment of inertia of areas
Calculating shear and moment in simple beams
Calculating bending and shearing stresses in simple beams
Designing simple wood or steel beams of standard cross section
Calculating deflection of simple beams
Designing structural cross sections for statically indeterminate beams
Designing structural cross sections for steel and wood columns
Calculating bending stress with tensile or compressive stress in beams and columns

Design Drafting IV
Analyzing the operation of gas and electric hot air heating and electric air cooling systems for residences and small commercial buildings
Drawing heating, cooling and ventilating duct systems
Drawing heating, cooling and ventilating system details
Drawing water distribution and sanitary draining systems for small commercial buildings

Technical Science III
Calculating fluid pressure
Calculating fluid velocity
Calculating buoyant force
Describing vibrating systems
Defining the structure of matter
Changing units of temperature
Calculating thermal expansion
Calculating heat transfer
Calculating thermodynamic coordinates of substances
Calculating work done by heat engines

CERTIFICATE OF COMPETENCY

This is to Certify that

of

has successfully mastered the competencies required to perform the job of

DRAFTER, CIVIL

The student named on this certificate has demonstrated mastery of the following unit level competencies required to perform the job of Drafter, Civil.

DRAFTER, CIVIL
(D.O.T. Code 005.281-010)

Theory of Shape Description
Hand lettering
Sketching freehand
Analyzing drawings for acceptable drafting practice
Drawing plane figures
Drawing with line contrast
Drawing to scale
Drawing in orthographic
Dimensioning
Drawing in isometric

Theory of Shape Description II
Drawing auxiliary views
Drawing fundamental views
Connecting skew lines
Locating piercing points
Drawing plane intersections
Determining dihedral angle
Determining true length with revolution
Drawing intersecting solids
Measuring distance
Measuring angles
Measuring elevations
Surveying polygonal areas

Technical Science and Strength of Materials
Transforming units
Calculating resultant force
Calculating forces in static systems
Calculating stress
Calculating strain
Calculating deformation
Calculating restoring force
Designing area of materials under stress
Calculating frictional forces

Design Drafting I
Drawing fasteners
Drawing welds
Dimensioning tolerances
Drawing gears
Drawing cams
Drawing details
Drawing assemblies
Drawing charts
Drawing graphs
Sketching designs
Drawing sections

Technical Science II
Calculating mass
Describing motion in one dimension
Describing motion resulting from forces
Describing motion resulting from torques
Describing motion using momentum principles
Describing motion using energy principles
Calculating work
Calculating power
Calculating efficiency

Design Drafting II
Lettering architecturally
Researching and analyzing accepted principles and methods of construction
Researching and interpreting the Southern Standard Building Code
Drawing and reading small commercial survey plots
Drawing a small commercial building foundation plan
Drawing light commercial building details
Aiding the architect in organizing and reproducing specifications for a small commercial building

Technical Science III
Calculating fluid pressure
Calculating fluid velocity
Calculating buoyant force
Describing vibrating systems
Defining the structure of matter
Changing units of temperature
Calculating thermal expansion
Calculating heat transfer
Calculating thermodynamic coordinates of substances
Calculating work done by heat engines

GROUP PROGRESS CHART

NAME	UNITS/TASKS																				

SECTION VI

FACILITIES

SECTION VI

Section VI Content List

Group Instruction Facilities
Individualized Instruction Facilities

The facility layouts on the following pages are presented to aid in arranging the classroom and laboratory for efficient instruction. The school administration and program instructor must determine an arrangement that best fits the needs of the students by determining the most efficient use of resources available to them not only in the laboratory, but also in the Learning Resource Center settings.

FACILITY LAYOUTS

The layouts on the following pages illustrate how facilities for group and individualized instructional programs may be planned and set up.

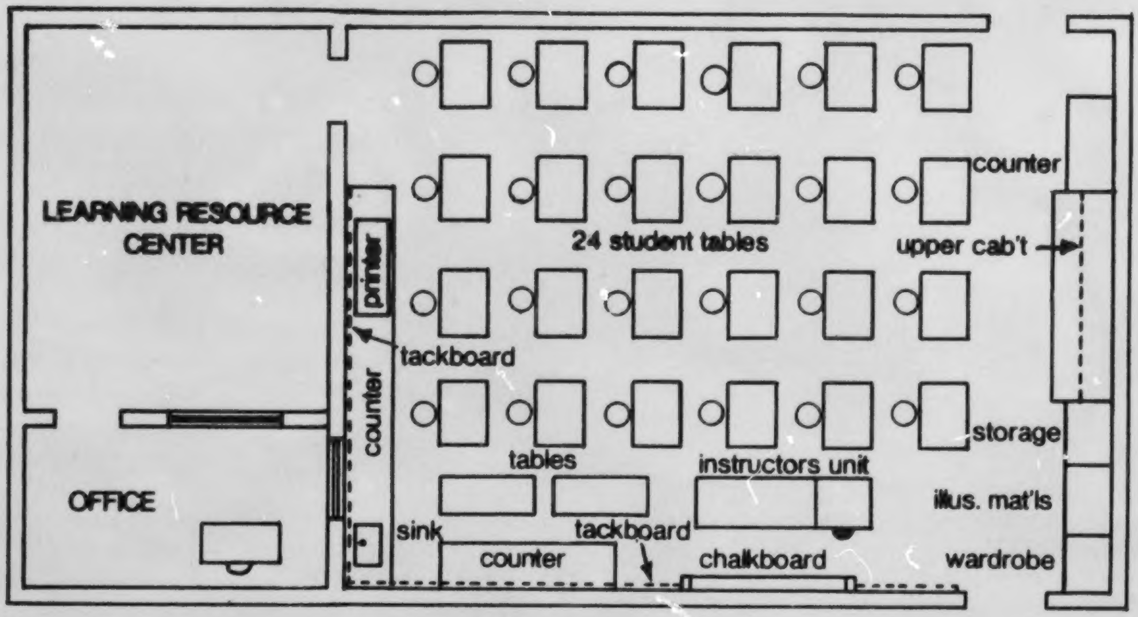
Each instructional approach has two important physical areas. These are (1) the laboratory (work) area and classroom for group instruction and (2) the laboratory (work) area and learning resource center (LRC) for individualized instruction.

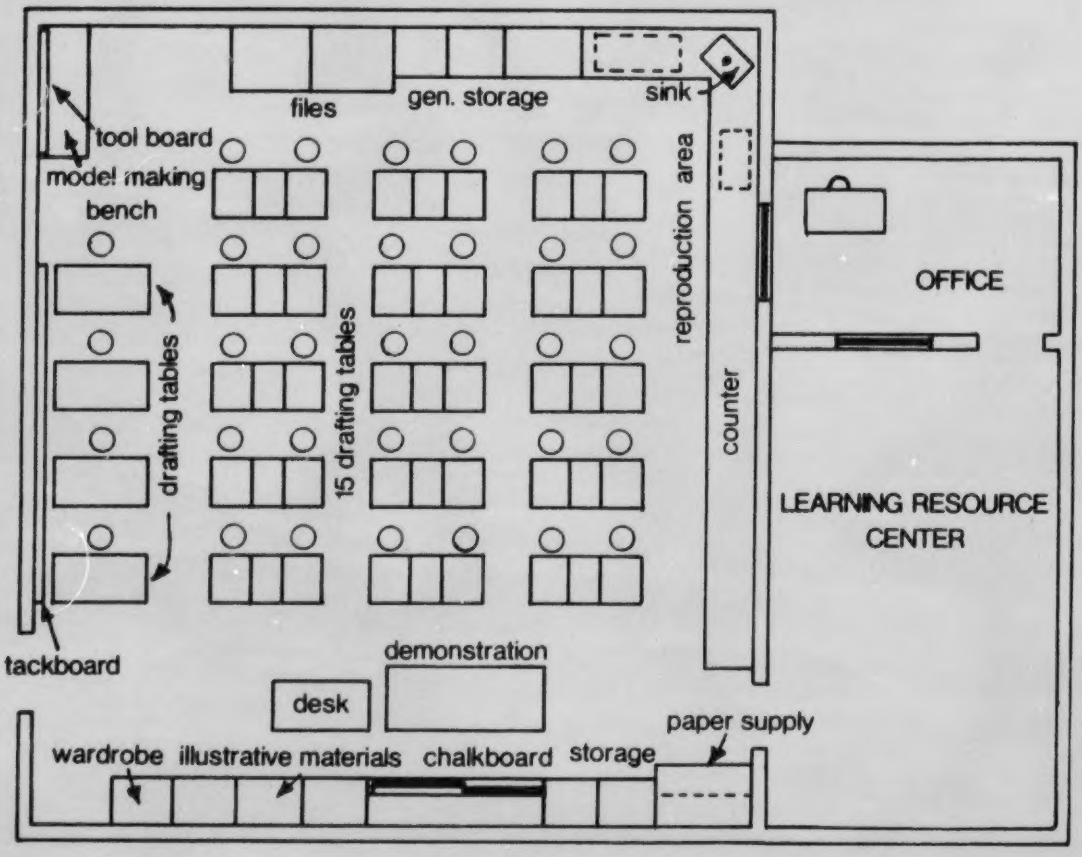
The instructional setting for group instruction is based on that of a traditional classroom. This approach is easily set up and includes little or no modifications. The primary modes of learning are instructor lectures, occasional use of audiovisual aids and student participation. Ideally, all students progress at the same pace.

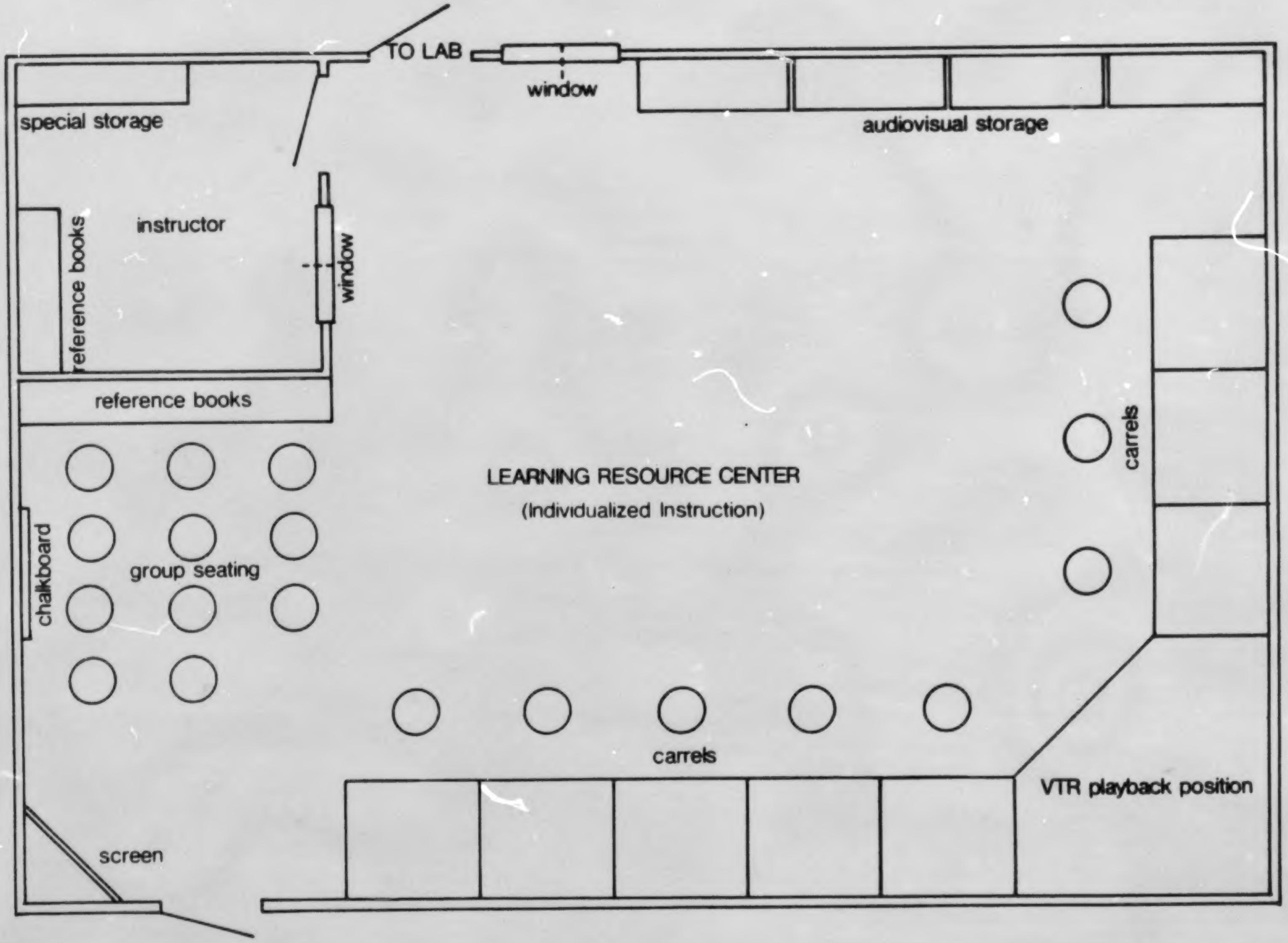
The instructional setting for individual instruction is designed to facilitate a student self-paced progression of learning. The LRC requires careful planning in utilizing available space. When planning to install an individual instruction program in an area not originally designed for this approach, the instructional setting may need modifications. Desks may be replaced with study carrels to allow students to simultaneously participate in a variety of learning activities. A group session area for small group gatherings should also be included. Because the instructor and students rarely meet together as a group, a bulletin board becomes a vital communication device in an LRC. It can be used to post announcements and such instructional information as group progress charts, assignments, positions available in the industry and safety rules.

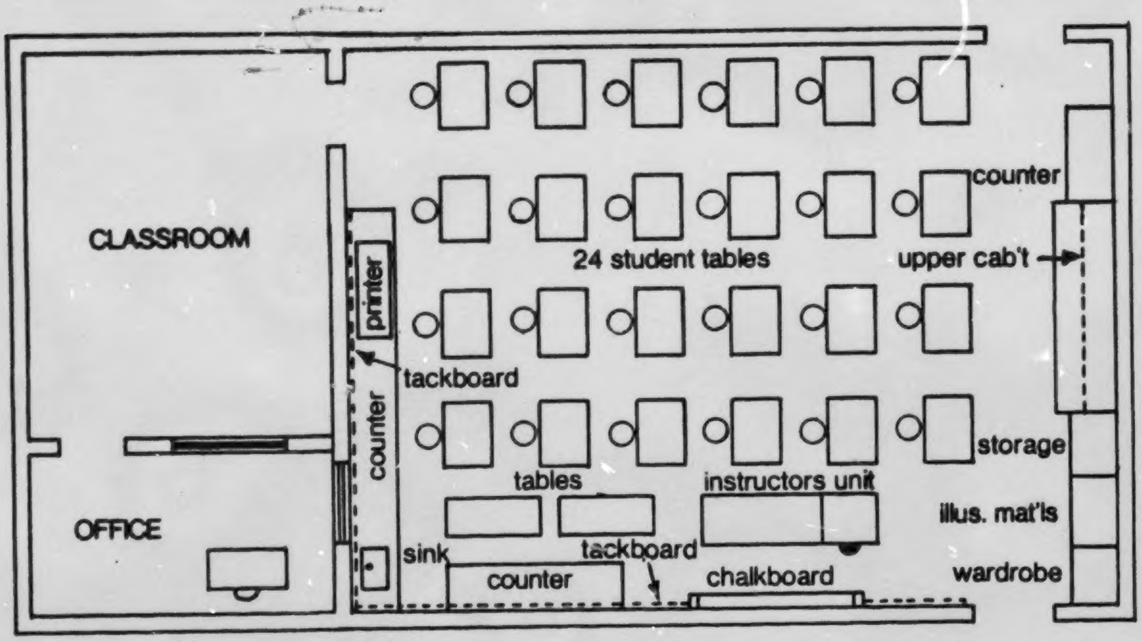
A variety of references, resources and media equipment should be made available to the student. Therefore, an adequate amount of storage area should be included in planning the LRC. Every specific school and department has unique physical layout characteristics and problems. Through innovation, these features may be transformed into LRC advantages rather than disadvantages.

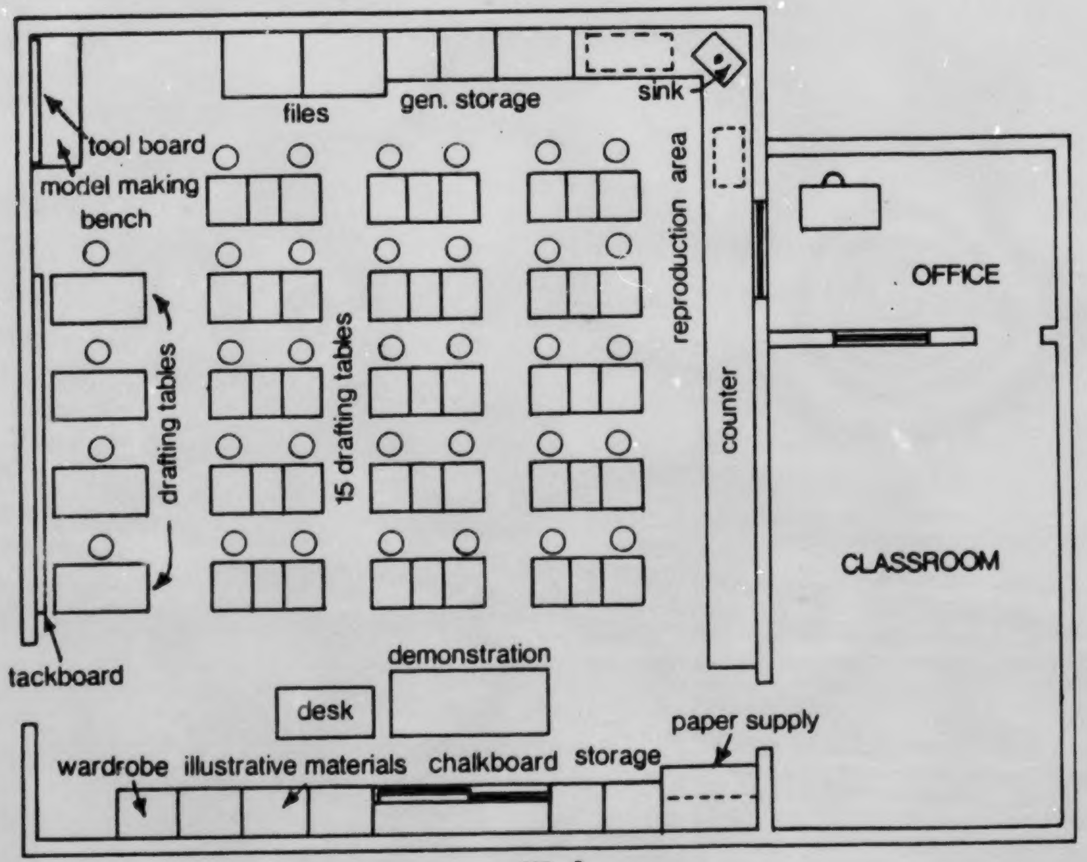
The manner in which the laboratory (work) area is planned and set up need not be affected by the type of instructional approach used by an instructor; it could/will be the same. Some major concerns in the laboratory are: 1) the instructor must always have a clear line of sight to each and every workstation, 2) tools must be accessible to students, but under the control of the instructor and 3) all supplies and materials required for the day's activities must be on hand and ready to use.

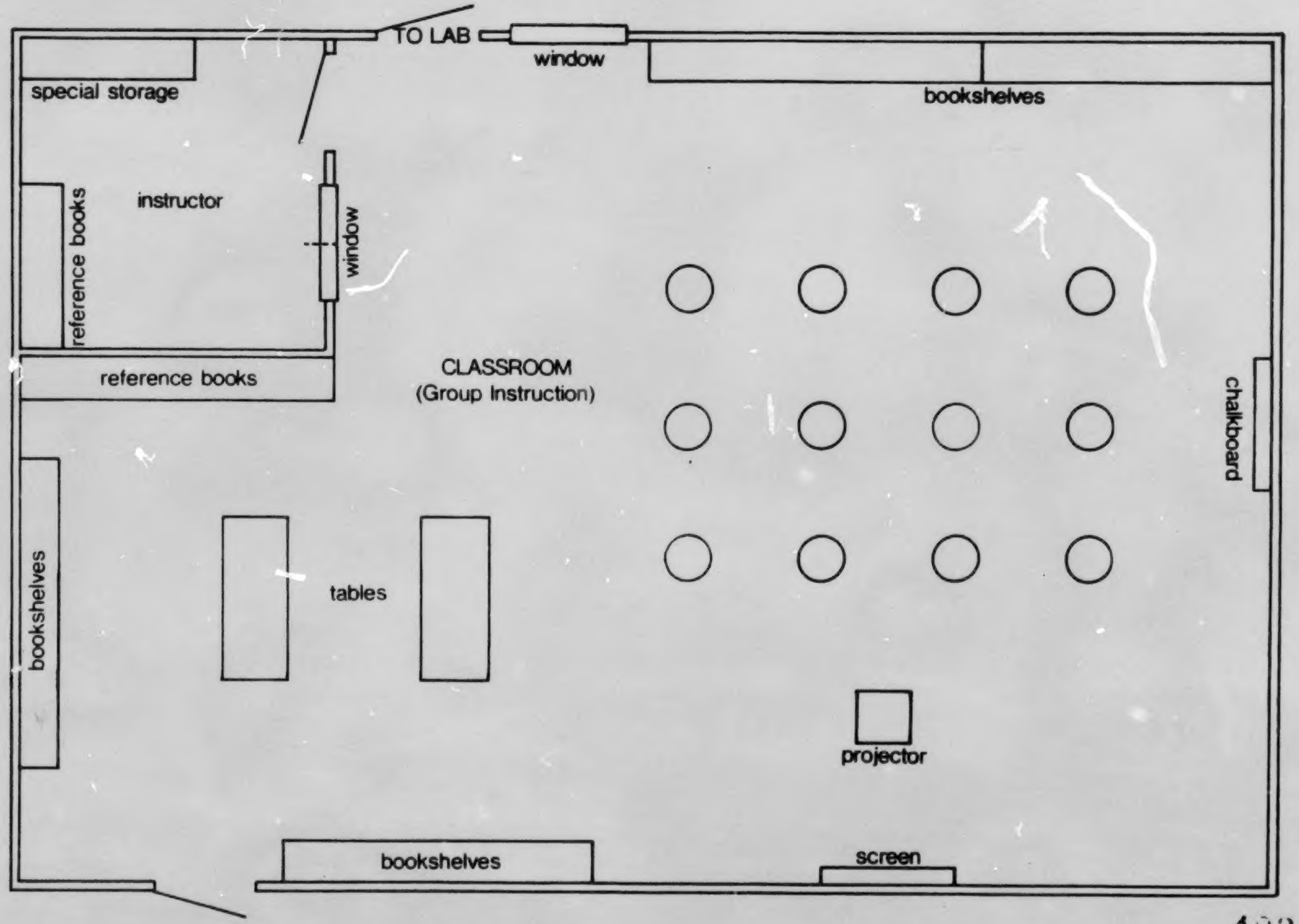

LEARNING RESOURCE CENTER
OFFICE
printer
tackboard
counter
sink
24 student tables
counter
upper cab't
storage
tables
instructors unit
illus. mat'ls
tackboard
counter
chalkboard
wardrobe


files
gen. storage
sink
tool board
model making bench
reproduction area
drafting tables
15 drafting tables
counter
OFFICE
LEARNING RESOURCE CENTER
tackboard
demonstration
desk
paper supply
wardrobe
illustrative materials
chalkboard
storage


TO LAB
window
special storage
audiovisual storage
instructor
reference books
window
reference books
LEARNING RESOURCE CENTER
(Individualized Instruction)
carrels
chalkboard
group seating
carrels
VTR playback position
screen


CLASSROOM
OFFICE
printer
tackboard
counter
sink
24 student tables
counter
upper cab't
storage
tables
instructors unit
illus. mat'ls
tackboard
counter
chalkboard
wardrobe


files
gen. storage
sink
tool board
model making
bench
reproduction area
OFFICE
drafting tables
15 drafting tables
counter
CLASSROOM
tackboard
demonstration
desk
paper supply
wardrobe
illustrative materials
chalkboard
storage


TO LAB
window
special storage
bookshelves
instructor
reference books
window
reference books
CLASSROOM
(Group Instruction)
chalkboard
bookshelves
tables
projector
bookshelves
screen

APPENDIX A

Resources

RESOURCES

This appendix contains the instructional resource matrix, unit guide references, additional instructional materials and resource addresses.

The instructional resource matrix lists the audiovisuals, textbooks and student manuals for each task referenced on unit guide sheets. The audiovisual format is identified by symbols such as: filmstrip (FS), slide/script (SS), slide/tape (ST), 16mm movie film (MF), transparency (TR), video tape (VT) and filmloop (FL). The producer and title of the A/V is also given.

The unit guide bibliography lists textbooks, audiovisuals and student manuals and evaluation materials cited in the unit guides section.

The additional instructional materials is a compilation of textbooks not included in the unit guides but beneficial to educators.

Resource addresses for all references conclude this appendix.

CURRICULUM AREA: DRAFTING/DESIGN TECHNOLOGY

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
SDI-01 Hand lettering	Barr Films: "Lettering," Drafting Series I, (FS); Georgia: "Using a Lettering Guide," (ST); "Using Lettering Devices," (ST)	French, Svensen, Helsel and Urbanick: Mechanical Drawing; French and Vierck: Engineering Drawing and Graphic Technology; Giesecke, et al.: Technical Drawing; Jensen and Helsel: Fundamentals of Engineering Drawing	Georgia: Drafting, Basic, Unit 18; Gerevas: Drafting Technology Problems
SDI-02 Sketching freehand	Georgia: "Perspective Sketching," (ST)	French, Svensen, Helsel and Urbanick: Mechanical Drawing; French and Vierck: Engineering Drawing and Graphic Technology; Giesecke, et al.: Technical Drawing; Jensen and Helsel: Fundamentals of Engineering Drawing	Georgia, Drafting, Basic, Unit 42
SDI-03 Analyzing drawings for acceptable drafting practice		French, Engineering Drawing; French, Svensen, Helsel and Urbanick: Mechanical Drawing; Giesecke, et al.: Technical Drawing; Jensen and Helsel: Fundamentals of Engineering Drawing; Spence: Basic Industrial Drafting; Drafting: Technology and Practice	

CURRICULUM AREA: DRAFTING/DESIGN TECHNOLOGY

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
SDI-04 Drawing plane figures		French: Engineering Drawing; French, Svensen, Helsel and Urbanick: Mechanical Drawing; Giesecke, et al.: Technical Drawing; Jensen and Helsel: Fundamentals of Engineering Drawing; Spence: Basic Industrial Drafting; Drafting: Technology and Practice	Gerevas: Drafting Technology Problems
SDI-05 Drawing with line contrast		French: Engineering Drawing; French, Svensen, Helsel and Urbanick: Mechanical Drawing; Giesecke, et al.: Technical Drawing; Jensen and Helsel: Fundamentals of Engineering Drawing; Spence: Basic Industrial Drafting; Drafting: Technology and Practice	
SDI-06 Drawing to scale		French: Engineering Drawing; French, Svensen, Helsel and Urbanick: Mechanical Drawing; Giesecke, et al.: Technical Drawing; Jensen and Helsel: Fundamentals of Engineering Drawing; Spence: Basic Industrial Drafting; Drafting: Technology and Practice	Gerevas: Drafting Technology Problems

CURRICULUM AREA: DRAFTING/DESIGN TECHNOLOGY

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
SDI-07 Drawing in orthographic		French: Engineering Drawing; French, Svensen, Helsel and Urbanick: Mechanical Drawing; Giesecke, et al.: Technical Drawing; Jensen and Helsel: Fundamentals of Engineering Drawing; Spence: Basic Industrial Drafting; Drafting: Technology and Practice	Gerevas: Drafting Technology Problems
SDI-08 Dimensioning	Barr Films: "Size Description," Drafting Series I, (FS)	French: Engineering Drawing; French, Svensen, Helsel and Urbanick: Mechanical Drawing; Giesecke, et al.: Technical Drawing; Jensen and Helsel: Fundamentals of Engineering Drawing; Spence: Basic Industrial Drafting; Drafting: Technology and Practice	Gerevas: Drafting Technology Problems
SDI-09 Drawing in isometric	Barr Films: "Isometric Drawing," Drafting Series I, (FS); Georgia: "Constructing an Isometric Drawing," (ST); "Incline and Oblique Lines in Isometric," (ST)	French: Engineering Drawing; French, Svensen, Helsel and Urbanick: Mechanical Drawing; Giesecke, et al.: Technical Drawing; Jensen and Helsel: Fundamentals of Engineering Drawing; Spence: Basic Industrial Drafting; Drafting: Technology and Practice	Georgia: Drafting, Basic, Unit 41; Gerevas: Drafting Technology Problems

CURRICULUM AREA: DRAFTING/DESIGN TECHNOLOGY

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audiovisuals	Textbooks	Student Materials
SDII-01	Drawing auxiliary views	Barr Films: "Auxiliary Views," Drafting Series II, (FS); Georgia: "Primary Auxiliary Views," (ST)	Brown: Drafting for Industry; French and Vierek: Engineering Drawing and Graphic Technology; Giesecke, et al.: Technical Drawing; Hawk: Descriptive Geometry; Hoelscher, Springer and Dobrovolny: Graphics for Engineers; Jensen and Helsel: Fundamentals of Engineering Drawing; Spence: Basic Industrial Drafting; Drafting: Technology and Practice	Georgia: Drafting, Basic, Units 201 and 202; Hawk: Descriptive Geometry
SDII-02	Drawing fundamental views		Hoelscher, Springer and Dobrovolny: Graphics for Engineers; Luzadder: Fundamentals of Engineering Drawing; Hawk: Descriptive Geometry; Warner and McNeary: Applied Descriptive Geometry	Hawk: Descriptive Geometry
SDII-03	Connecting skew lines		Hawk: Descriptive Geometry; Warner and McNeary: Applied Descriptive Geometry	Hawk: Descriptive Geometry
SDII-04	Locating piercing points		Hawk: Descriptive Geometry; Warner and McNeary: Applied Descriptive Geometry	Hawk: Descriptive Geometry

CURRICULUM AREA: DRAFTING/DESIGN TECHNOLOGY

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
SDII-05 Drawing plane intersections		Giesecke, et al.: Technical Drawing; Hawk: Descriptive Geometry; Hoelscher, Springer and Dobrovolny: Graphics for Engineers; Warner and McNeary: Applied Descriptive Geometry	Hawk: Descriptive Geometry
SDII-06 Determining dihedral angle		Hawk: Descriptive Geometry; Hoelscher, Springer and Dobrovolny: Graphics for Engineers; Luzadder: Fundamentals of Engineering Drawing; Warner and McNeary: Applied Descriptive Geometry	Hawk: Descriptive Geometry
SDII-07 Determining true length with revolution		Giesecke, et al.: Technical Drawing; Hawk: Descriptive Geometry; Hoelscher, Springer and Dobrovolny: Graphics for Engineers; Luzadder: Fundamentals of Engineering Drawing; Warner and McNeary: Applied Descriptive Geometry	Hawk: Descriptive Geometry

CURRICULUM AREA: DRAFTING/DESIGN TECHNOLOGY

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
SDII-08 Drawing intersecting solids		French and Vierck: Engineering Drawing and Graphic Technology; Giesecke, et al.: Technical Drawing; Hawk: Descriptive Geometry; Hoelscher, Springer and Dobrovolny: Graphics for Engineers; Jensen and Helsel: Fundamentals of Engineering Drawing; Luzadder: Fundamentals of Engineering Drawing; Spence: Basic Industrial Drafting; Drafting Technology and Practice; Warner and McNeary: Applied Descriptive Geometry	Hawk: Descriptive Geometry
SDII-09 Drawing developments		Betterley: Sheet Metal Drafting; French and Vierck: Engineering Drawing and Graphic Technology; Giesecke, et al.: Technical Drawing; Hawk: Descriptive Geometry; Hoelscher, Springer and Dobrovolny: Graphics for Engineers; Jensen and Helsel: Fundamentals of Engineering Drawing; Luzadder: Fundamentals of Engineering Drawing; Spence: Basic Industrial Drafting; Drafting Technology and Practice	Georgia: Drafting, Advanced, Unit 5-M; Hawk: Descriptive Geometry

CURRICULUM AREA: DRAFTING/DESIGN TECHNOLOGY

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
SDII-10 Measuring distance		Davis, Foote and Kelly: Elementary Plane Surveying; Herubin: Principles of Surveying; Kissam: Surveying Practice	
SDII-11 Measuring angles		Davis, Foote and Kelly: Elementary Plane Surveying; Herubin: Principles of Surveying; Kissam: Surveying Practice	Georgia, Drafting, Advanced, Unit 3-C
SDII-12 Measuring elevations		Davis, Foote and Kelly: Elementary Plane Surveying; Herubin: Principles of Surveying; Kissam: Surveying Practice	Georgia, Drafting, Advanced, Units 7-C and 8-C
SDII-13 Surveying polygonal areas	Georgia: "Surveying in Georgia," (ST)	Davis, Foote and Kelly: Elementary Plane Surveying; Herubin: Principles of Surveying; Kissam: Surveying Practice	Georgia, Drafting, Advanced, Units 1-C and 4-C

CURRICULUM AREA: DRAFTING/DESIGN TECHNOLOGY

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
TSSM-01 Transforming units		Marcus and Thrower: Introduction to Applied Physics; Zebrowski: Physics for the Technician	
TSSM-02 Calculating resultant force		Jensen and Chenoweth: Applied Strength of Materials; Levinson: Statics and Strength of Materials; Marcus and Thrower: Introduction to Applied Physics; Zebrowski: Physics for the Technician	
TSSM-03 Calculating forces in static systems		Bassin, Brodsky and Wolkoff: Statics and Strength of Materials; Jensen and Chenoweth: Applied Strength of Materials; Levinson: Statics and Strength of Materials; Zebrowski: Physics for the Technician	
TSSM-04 Calculating stress		Bruch: Strength of Materials; Jensen and Chenoweth: Applied Strength of Materials; Levinson: Statics and Strength of Materials; Zebrowski: Physics for the Technician	

CURRICULUM AREA: DRAFTING/DESIGN TECHNOLOGY

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
TSSM-05 Calculating strain		Bruch: Strength of Materials for Technology; Jensen and Chenoweth: Applied Strength of Materials; Levinson: Statics and Strength of Materials; Zebrowski: Physics for the Technician	
TSSM-06 Calculating deformation		Bruch: Strength of Materials for Technology; Jensen and Chenoweth: Applied Strength of Materials; Levinson: Statics and Strength of Materials; Zebrowski: Physics for the Technician	
TSSM-07 Calculating restoring force		Bruch: Strength of Materials for Technology; Jensen and Chenoweth: Applied Strength of Materials; Levinson: Statics and Strength of Materials; Zebrowski: Physics for the Technician	
TSSM-08 Designing area of materials under stress		Bruch: Strength of Materials for Technology; Jensen and Chenoweth: Applied Strength of Materials; Levinson: Statics and Strength of Materials; Zebrowski: Physics for the Technician	

CURRICULUM AREA: DRAFTING/DESIGN TECHNOLOGY

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
TSSM-09 Calculating frictional forces		Marcus and Thrower: Introduction to Applied Physics; Olivo and Olivo: Fundamentals of Applied Physics; Pollack: Applied Physics; Zebrowski: Physics for the Technician	

CURRICULUM AREA: DRAFTING/DESIGN TECHNOLOGY

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
DDI-01 Drawing fasteners	Barr Films: "Fasteners," Drafting Series II, (FS); Georgia: "Drawing Threads," (ST)	Coover and Helsel: Programmed Blueprint Reading; French and Vierck: Engineering Drawing and Graphic Technology; Giesecke, et al.: Technical Drawing Jensen and Helsel: Fundamentals of Engineering Drawing; Luzadder: Fundamentals of Engineering Drawing; Spence: Basic Industrial Drafting; Drafting: Technology and Practice	Coover and Helsel: Programmed Blueprint Reading; Georgia: Drafting, Advanced, Units 1-M and 2-M; Gerevas: Drafting Technology Problems
DDI-02 Drawing welds		French, Svensen, Helsel and Urbanick: Mechanical Drawing; French and Vierck: Engineering Drawing and Graphic Technology; Giesecke, et al.: Technical Drawing; Jensen and Helsel: Fundamentals of Engineering Drawing; Luzadder: Fundamentals of Engineering Drawing; Spence: Basic Industrial Drafting; Drafting: Technology and Practice	Georgia, Drafting, Advanced, Unit 4-M; Gerevas: Drafting Technology Problems

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CURRICULUM AREA: DRAFTING/DESIGN TECHNOLOGY

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
DDI-03 Dimensioning tolerances		French, Svensen, Helsel and Urbanick: Mechanical Drawing; French and Vierck: Engineering Drawing and Graphic Technology; Giesecke, et al.: Technical Drawing; Jensen and Helsel: Fundamentals of Engineering Drawing; Luzadder: Fundamentals of Engineering Drawing; Spence: Basic Industrial Drafting; Drafting: Technology and Practice	Coover and Helsel: Programmed Blueprint Reading; Gerevas: Drafting Technology Problems
DDI-04 Drawing gears		French, Svensen, Helsel and Urbanick: Mechanical Drawing; French and Vierck: Engineering Drawing and Graphic Technology; Giesecke, et al.: Technical Drawing; Jensen and Helsel: Fundamentals of Engineering Drawing; Luzadder: Fundamentals of Engineering Drawing; Spence: Basic Industrial Drafting; Drafting: Technology and Practice	Georgia: Drafting, Advanced, Unit 3-M; Gerevas: Drafting Technology Problems

CURRICULUM AREA: DRAFTING/DESIGN TECHNOLOGY

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
DDI-05 Drawing cams		French, Svensen, Helsel and Urbanick: Mechanical Drawing; French and Vierck: Engineering Drawing and Graphic Technology; Giesecke, et al.: Technical Drawing; Jensen and Helsel: Fundamentals of Engineering Drawing; Luzadder: Fundamentals of Engineering Drawing; Spence: Basic Industrial Drafting; Drafting: Technology and Practice	Georgia: Drafting, Advanced, Unit 3-M; Gerevas: Drafting Technology Problems
DDI-06 Drawing details	Barr Films: "Assembly and Detail Drawings," Drafting Series II, (FS); Georgia: "Working Drawings," (ST)	French, Svensen, Helsel and Urbanick: Mechanical Drawing; French and Vierck: Engineering Drawing and Graphic Technology; Giesecke, et al.: Technical Drawing; Jensen and Helsel: Fundamentals of Engineering Drawing; Luzadder: Fundamentals of Engineering Drawing; Spence: Basic Industrial Drafting; Drafting: Technology and Practice	Georgia: Drafting, Basic, Unit 51; Gerevas: Drafting Technology Problems

CURRICULUM AREA: DRAFTING/DESIGN TECHNOLOGY

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
DDI-07 Drawing assemblies	Barr Films: "Assembly and Detail Drawings," (FS); Georgia: "Working Drawings," (ST)	French, Svensen, Helsel and Urbanick: Mechanical Drawing; French and Vierck: Engineering Drawing and Graphic Technology; Giesecke, et al.: Technical Drawing; Jensen and Helsel: Fundamentals of Engineering Drawing; Luzadder: Fundamentals of Engineering Drawing; Spence: Basic Industrial Drafting; Drafting: Technology and Practice	Georgia: Drafting, Basic, Unit 51; Gerevas: Drafting Technology Problems
DDI-08 Drawing charts	Georgia: "Shading and Coloring Techniques," (ST)	French and Vierck: Engineering Drawing and Graphic Technology; Giesecke, et al.: Technical Drawing; Jensen and Helsel: Fundamentals of Engineering Drawing; Luzadder: Fundamentals of Engineering Drawing; Spence: Basic Industrial Drafting; Drafting: Technology and Practice	Georgia: Drafting, Basic, Unit 17; Gerevas: Drafting Technology Problems
DDI-09 Drawing graphs		Giesecke, et al.: Technical Drawing; Luzadder: Fundamentals of Engineering Drawing	Georgia: Drafting, Basic, Unit 16

CURRICULUM AREA: DRAFTING/DESIGN TECHNOLOGY

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
DDI-10 Sketching designs		Giesecke, et al.: Technical cal Drawing; Jensen and Helsel: Fundamentals of Engineering Drawing; Luzadder: Fundamentals of Engineering Drawing	
DDI-11 Drawing sections	Barr Films: "Sections," Drafting Series I, (FS); Georgia: "Sections," (ST)	French and Svensen: Mechanical Drawing; French and Vierck: Engineering Drawing and Graphic Technology; Giesecke, et al.: Technical Drawing; Jensen and Helsel: Fundamentals of Engineering Drawing; Spence: Basic Industrial Drafting; Drafting: Technology and Practice	Georgia: Drafting, Basic, Units 31, 32, 33 and 34; Gerevas: Drafting Technology Problems

CURRICULUM AREA: DRAFTING/DESIGN TECHNOLOGY

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
TSII-01 Calculating mass		Harris and Hemmerling: Introductory Applied Physics; Marcus and Thrower: Introduction to Applied Physics; Pollack: Applied Physics; Zebrowski: Physics for the Technician	
TSII-02 Describing motion on one dimension		Harris and Hemmerling: Introductory Applied Physics; Marcus and Thrower: Introduction to Applied Physics; Pollack: Applied Physics; Zebrowski: Physics for the Technician	
TSII-03 Describing motion resulting from forces		Harris and Hemmerling: Introductory Applied Physics; Marcus and Thrower: Introduction to Applied Physics; Pollack: Applied Physics; Zebrowski: Physics for the Technician	
TSII-04 Describing motion resulting from torques		Harris and Hemmerling: Introductory Applied Physics; Marcus and Thrower: Introduction to Applied Physics; Pollack: Applied Physics; Zebrowski: Physics for the Technician	

CURRICULUM AREA: DRAFTING/DESIGN TECHNOLOGY

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
TSII-05 Describing motion using momentum principles		Harris and Hemmerling: Introductory Applied Physics; Marcus and Thrower: Introduction to Applied Physics; Pollack: Applied Physics; Zebrowski: Physics for the Technician	
TSII-06 Describing motion using energy principles		Harris and Hemmerling: Introductory Applied Physics; Marcus and Thrower: Introduction to Applied Physics; Pollack: Applied Physics; Zebrowski: Physics for the Technician	
TSII-07 Calculating work		Harris and Hemmerling: Introductory Applied Physics; Marcus and Thrower: Introduction to Applied Physics; Pollack: Applied Physics; Zebrowski: Physics for the Technician	
TSII-08 Calculating power		Harris and Hemmerling: Introductory Applied Physics; Marcus and Thrower: Introduction to Applied Physics; Pollack: Applied Physics; Zebrowski: Physics for the Technician	

CURRICULUM AREA: DRAFTING/DESIGN TECHNOLOGY

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
TSII-09 Calculating efficiency		Harris and Hemmerling: Introductory Applied Physics; Marcus and Thrower: Introduction to Applied Physics; Pollack: Applied Physics; Zebrowski: Physics for the Technician	

CURRICULUM AREA: DRAFTING/DESIGN TECHNOLOGY

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
DDII-01 Lettering architecturally		Goodban and Hayslett: Architectural Drawing and Planning; Muller: Architectural Drawing and Light Construction	
DDII-02 Researching and analyzing accepted principles and methods of construction	Casettes Unlimited: "The World of the Construction Site: Residential Architecture," (FS); "The World of the Construction Site: Commercial Architecture," (FS)	Ching: Building Construction Illustrated; Goodban and Hayslett: Architecture Drawing and Planning; Hornbostel: Construction Materials: Types, Uses and Applications; Muller: Architectural Drawing and Light Construction; Putnam and Carlson: Architectural Building Trades Dictionary; Ramsey and Sleeper: Architectural Graphic Standards; Schmidt, Olin and Lewis: Construction Principles, Materials and Methods; Smith: Principles and Practices of Light Construction; Spence: Architecture: Design, Engineering, Drawing	
DDII-03 Researching and interpreting the Southern Standard Building Code		Southern Building Code Congress, Inc.: The Standard Building Code	

CURRICULUM AREA: DRAFTING/DESIGN TECHNOLOGY

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
DDII-04 Drawing with architectural expression		Goodban and Hayslett: *Architectural Drawing and Planning*; Muller: *Architectural Drawing and Light Construction*; Putnam and Carlson: *Architectural and Building Trades Dictionary*; Spence: *Architecture: Design, Engineering, Drawing*	
DDII-05 Aiding the architect in designing preliminary floor plans		Frishman, Loshak and trelka: *Metric Architectural Drawing*; Goodban and Hayslett: *Architectural Drawing and Planning*; Hornbostel: *Construction Materials: Types, Uses and Applications*; Muller: *Architectural Drawing and Light Construction*	
DDII-06 Drawing finished floor plans	Georgia: "Drawing a Floor Plan," (ST)	Frishman, Loshak and Strelka: *Metric Architectural Drawing*; Goodban and Hayslett: *Architectural Drawing and Planning*; Hornbostel: *Construction Materials: Types, Uses and Applications*; Muller: *Architectural Drawing and Light Construction*; Spence: *Architecture: Design, Engineering, Drawing*	Georgia: *Drafting, Advanced*, Unit 2-A

CURRICULUM AREA: DRAFTING/DESIGN TECHNOLOGY

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
DDII-07 Drawing and reading small commercial survey plats	Georgia: "Surveying in Georgia," (ST)	Davis, Foote and Kelly: Surveying: Theory and Practice; Herubin: Principles of Surveying; Kissam: Surveying Practice	Georgia: Drafting, Advanced, Units 1-C through 8-C
DDII-08 Drawing a small commercial building foundation plan	Georgia: "Drawing a Foundation Plan," (ST)	Ambrose: Simplified Design of Building Structures; Frishman, Loshak and Strelka: Metric Architectural Drawing and Planning; Goodban and Hayslett: Architectural Drawing and Planning; Hornbostel: Construction Materials: Types, Uses and Applications	Georgia: Drafting, Advanced, Unit 3-A
DDII-09 Drawing small commercial building elevations	Georgia: "How to Draw Elevations," (ST)	Goodban and Hayslett: Architectural Drawing and Planning; Muller: Architectural Drawing and Light Construction; Spence: Architecture: Design, Engineering, Drawing	Georgia: Drafting, Advanced, Unit 5-A

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
DDII-10 Drawing light commercial building details		Frishman, Loshak and Strelka: Metric Architectural Drawing and Planning; Goodban and Hayslett: Architectural Drawing and Planning; Hornbostel: Construction Materials: Types, Uses and Applications; Muller: Architectural Drawing and Light Construction; Spence: Architecture: Design, Engineering, Drawing	

CURRICULUM AREA: DRAFTING/DESIGN TECHNOLOGY

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audiovisuals	Textbooks	Student Materials
DDII-11	Aiding the architect in organizing and reproducing specifications for a small commercial building		American Institute of Timber Construction: Timber Construction Manual; Ching: Building Construction Illustrated; Goodban and Hayslett: Architectural Drawing and Planning; Hornbostel: Construction Materials: Types, Uses and Applications; Miller: Architectural Drawing and Light Construction; National Association of Women in Construction: Construction Dictionary; Rathbun: Building Construction Specifications; Schmidt, Olin and Lewis: Construction Principles, Materials and Methods; Smith: Principles of Light Construction; Spence: Architecture: Design, Engineering, Drawing; Watson: Specifications Writing for Architects and Engineers	

CURRICULUM AREA: DRAFTING/DESIGN TECHNOLOGY

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audiovisuals	Textbooks	Student Materials
DDIII-01	Defining terminology and analyzing theory associated with basic D.C. circuits	Audio Active, Inc.: "Basic Electricity Program," (CT)	Snow: Electrical Drafting; Zbar: Basic Electricity; Zebrowski: Physics for the Technician	Zbar: Basic Electricity
DDIII-02	Defining and converting electrical units associated with basic D.C. and A.C. circuits	Audio Active, Inc.: "Basic Electricity Program," (CT)	Grob: Basic Electronics; Shrader: Electronic Communication; Tandy Corp.: Electronics Data Book	
DDIII-03	Calculating basic D.C. series circuits	Audio Active, Inc.: "Basic Electricity Program," (CT); Bergwall Productions, Inc.: "Basic Electricity and Electronics: Direct Current," (FS); Creative Visuals: "Basic Electricity," (TR)	Shrader: Electronic Communication; Snow: Electrical Drafting and Design; Zbar: Basic Electricity	ESP, Inc.: Basic Electricity Program
DDIII-04	Calculating basic D.C. parallel circuits	Audio Active: "Basic Electricity Program," (CT): Bergwall Productions, Inc: "Basic Electricity and Electronics: Direct Current," (FS)	Grob: Basic Electronics; Shrader: Electronic Communication; Zbar: Basic Electricity	ESP, Inc.: Basic Electricity Program; Zbar: Basic Electricity
DDIII-05	Calculating basic D.C. series parallel circuits	Audio Active: "Basic Electricity Program," (CT); Bergwall Productions, Inc.: "Basic Electricity and Electronics: Direct Current," (FS)	Grob: Basic Electronics; Shrader: Electronic Communication; Zebrowski: Physics for the Technician	ESP, Inc.: Basic Electricity Program; Zbar: Basic Electricity

CURRICULUM AREA: DRAFTING/DESIGN TECHNOLOGY

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audiovisuals	Textbooks	Student Materials
DDIII-06	Defining terminology and analyzing theory associated with basic A.C. circuits	Audio Active: "Basic Electricity Program," (CT); Bergwall Productions, Inc.: "Basic Electricity and Electronics: Alternating Current," (FS)	Grob: Basic Electronics; Shrader: Electronic Communication; Zebrowski: Physics for the Technician	
DDIII-07	Calculating power factors, impedance and pure resistance in series A.C. circuits	Audio Active: "Basic Electricity Program," (CT); Bergwall Productions, Inc.: "Basic Electricity and Electronics: Alternating Current," (FS)	Grob: Basic Electronics; Shrader: Electronic Communication	ESP, Inc.: Basic Electricity Program
DDIII-08	Calculating basic series A.C. circuits with inductance reactance and resistance	Audio Active: "Basic Electricity Program," (CT); Bergwall Productions, Inc.: "Basic Electricity and Electronics: Alternating Current," (FS)	Grob: Basic Electronics; Shrader: Electronic Communication; Zbar: Basic Electricity	ESP, Inc.: Basic Electricity Program
DDIII-09	Calculating basic series A.C. circuits with capacitive reactance and resistance	Audio Active: "Basic Electricity Program," (CT); Bergwall Productions, Inc.: "Basic Electricity and Electronics: Alternating Current," (FS)	Grob: Basic Electronics; Shrader: Electronic Communication; Zbar: Basic Electricity	ESP, Inc.: Basic Electricity Program
DDIII-10	Calculating series A.C. circuits with capacitive and inductive reactance and resistance	Audio Active: "Basic Electricity Program," (CT); Bergwall Productions, Inc.: "Basic Electricity and Electronics: Alternating Current," (FS)	Grob: Basic Electronics; Shrader: Electronic Communication; Zbar: Basic Electricity	ESP, Inc.: Basic Electricity Program

CURRICULUM AREA: DRAFTING/DESIGN TECHNOLOGY

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audiovisuals	Textbooks	Student Materials
DDIII-11	Calculating basic impedance in parallel A.C. circuits	Audio Active: "Basic Electricity Program," (CT); Bergwall Productions, Inc.: "Basic Electricity and Electronics: Alternating Current," (FS)	Grob: Basic Electronics; Shrader: Electronic Communication; Zbar: Basic Electricity	ESP, Inc.: Basic Electricity Program
DDIII-12	Applying basic A.C. circuit theory when drawing residential cable layouts	Bergwall Productions, Inc.: "Electrical House Wiring Explained," (FS); "Residential Electrical Wiring-Planning and Roughing In," (FS); "Residential Electrical Wiring-Finishing the Installation," (FS); "Residential Electrical Wiring-Low Voltage and Special Circuits," (FS); DCA Educational Products: "Electrical Wiring-Residential," (TR)	Croft: American Electrician's Handbook; Mullin: Electrical Wiring-Residential; Snow: Electrical Drafting and Design	Georgia: Drafting, Advanced, Unit 7-A
DDIII-13	Applying basic A.C. circuit theory when drawing commercial cable layouts		Croft: American Electrician's Handbook; Mullin and Smith: Electrical Wiring-Commercial	
DDIII-14	Drawing electrical one-line diagrams		Snow: Electrical Drafting and Design	

CURRICULUM AREA: DRAFTING/DESIGN TECHNOLOGY

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
DDIII-15 Drawing electrical elementary diagrams		Snow: Electrical Drafting and Design	
DDIII-16 Drawing electronic schematic diagrams		Raskhodoff: Electronic Drafting and Design; Stiers: Electronic Drafting	
DDIII-17 Laying out, taping up and/or drawing basic printed circuit boards		Lindsey: The Design and Drafting of Printed Circuits; Raskhodoff: Electronic Drafting and Design	

CURRICULUM AREA: DRAFTING/DESIGN TECHNOLOGY

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
SMII-01 Calculating centroids of areas		Bassin, Brodsky and Wolkoff: Statics and Strength of Materials; Bruch: Strength of Materials for Technology; Jensen and Chenoweth: Applied Strength of Materials; Parker and Hauf: Simplified Design of Structural Steel; Simplified Design of Structural Wood	Parker and Hauf: Simplified Engineering for Architects and Builders
SMII-02 Calculating moment of inertia of areas		Bassin, Brodsky and Wolkoff: Statics and Strength of Materials; Bruch: Strength of Materials for Technology; Jensen and Chenoweth: Applied Strength of Materials; Parker and Hauf: Simplified Design of Structural Steel; Simplified Design of Structural Wood	Parker and Hauf: Simplified Engineering for Architects and Builders
SMII-03 Calculating shear and moment in simple beams		American Institute of Timber Construction: Timber Construction Manual; Bassin, Brodsky and Wolkoff: Statics and Strength of Materials; Bruch: Strength of Materials for Technology; Jensen and Chenoweth: Applied Strength of Materials; Parker and Hauf: Simplified Design of Structural Steel; Simplified Design of Structural Wood	Parker and Hauf: Simplified Engineering for Architects and Builders

CURRICULUM AREA: DRAFTING/DESIGN TECHNOLOGY

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
SMII-04 Calculating bending and shearing stresses in simple beams		American Institute of Timber Construction: Timber Construction Manual; Bassin, Brodsky and Wolkoff: Statics and Strength of Materials; Bruch: Strength of Materials for Technology; Jensen and Chenoweth: Applied Strength of Materials; Parker and Hauf: Simplified Design of Structural Steel; Simplified Design of Structural Wood	Parker and Hauf: Simplified Engineering for Architects and Builders; AISC: Manual of Steel Construction
SMII-05 Designing simple wood or steel beams of standard cross section		American Institute of Timber Construction: Timber Construction Manual; Bassin, Brodsky and Wolkoff: Statics and Strength of Materials; Bruch: Strength of Materials for Technology; Jensen and Chenoweth: Applied Strength of Materials; Parker and Hauf: Simplified Design of Structural Steel; Simplified Design of Structural Wood	Parker and Hauf: Simplified Engineering for Architects and Builders; AISC: Manual of Steel Construction

CURRICULUM AREA: DRAFTING/DESIGN TECHNOLOGY

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
SMII-06 Calculating deflection of simple beams		American Institute of Timber Construction: Timber Construction Manual; Bassin, Brodsky and Wolkoff: Statics and Strength of Materials; Bruch: Strength of Materials for Technology; Jensen and Chenoweth: Applied Strength of Materials; Parker and Hauf: Simplified Design of Structural Steel; Simplified Design of Structural Wood	Parker and Hauf: Simplified Engineering for Architects and Builders; AISC: Manual of Steel Construction
SMII-07 Designing structural cross sections for statically indeterminate beams		Bassin, Brodsky and Wolkoff: Statics and Strengths of Materials; Bruch: Strength of Materials for Technology; Jensen and Chenoweth: Applied Strength of Materials	Parker and Hauf: Simplified Engineering for Architects and Builders; AISC: Manual of Steel Construction
SMII-08 Designing structural cross sections for simple steel and wood columns		Ambrose: Simplified Design of Building Structures; Bassin, Brodsky and Wolkoff: Statics and Strength of Materials; Bruch: Strength of Materials for Technology; Jensen and Chenoweth: Applied Strength of Materials; Parker and Hauf: Simplified Design of Structural Wood	Parker and Hauf: Simplified Engineering for Architects and Builders; AISC: Manual of Steel Construction

CURRICULUM AREA: DRAFTING/DESIGN TECHNOLOGY

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
SMII-09 Calculating bending stress with tension or compressive stress in beams and columns		Bassin, Brodsky and Wolkoff: Statics and Strength of Materials; Bruch: Strength of Materials for Technology; Jensen and Chenoweth: Applied Strength of Materials	
SMII-10 Calculating torsional stresses in circular shafts		Bassin, Brodsky and Wolkoff: Statics and Strength of Materials; Bruch: Strength of Materials for Technology; Jensen and Chenoweth: Applied Strength of Materials	

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TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
DDIV-01 Analyzing the operation of gas and electric hot air heating and electric air cooling systems		McGuinness and Stein: Building Technology: Mechanical and Electrical Systems; Muller: Architectural Drawing and Light Construction, Spence: Architecture: Design-Engineering-Drawing	
DDIV-02 Drawing heating, cooling and ventilating duct systems		McGuinness and Stein: Building Technology: Mechanical and Electrical Systems; Traister: Practical Drafting for the HVAC Trades	
DDIV-03 Drawing heating, cooling and ventilating system details		McGuinness and Stein: Building Technology: Mechanical and Electrical Systems; Traister: Practical Drafting for the HVAC Trades	
DDIV-04 Analyzing plumbing systems		McGuinnes and Stein: Building Technology: Mechanical and Electrical Systems; Muller: Architectural Drawing and Light Construction; Spence: Architecture: Design-Engineering-Drawing; Traister: Practical Plumbing Drafting	

CURRICULUM AREA: DRAFTING/DESIGN TECHNOLOGY

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
DDIV-05 Drawing water distribution and sanitary drainage systems for residences		McGuinness and Stein: Building Technology: Mechanical and Electrical Systems; Muller: Architectural Drawing and Light Construction; Spence: Architecture: Design-Engineering-Drawing; Traister: Practical Plumbing Drafting	
DDIV-06 Drawing water distribution and sanitary drainage systems for small commercial buildings		McGuinness and Stein: Building Technology: Mechanical and Electrical Systems; Muller: Architectural Drawing and Light Construction; Spence: Architecture: Design-Engineering-Drawing; Traister: Practical Plumbing Drafting	
DDIV-07 Researching data for drawing a process piping working drawing		Jensen and Helsel: Engineering Drawing and Design; Weaver: Process Piping Design, Vols. 1 and 2; Process Piping Drafting	
DDIV-08 Drawing process piping flow diagrams using standard piping and instrumentation symbols		Jensen and Helsel: Engineering Drawing and Design; Weaver: Process Piping Design, Vols. 1 and 2; Process Piping Drafting	

CURRICULUM AREA: DRAFTING/DESIGN TECHNOLOGY

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
DDIV-09 Drawing isometric process piping diagrams		Jensen and Helsel: Engineering Drawing and Design; Weaver: Process Piping Design, Vols. 1 and 2; Process Piping Drafting	
DDIV-10 Drawing orthographic process piping drawings using standard symbols		Jensen and Helsel: Engineering Drawing and Design; Weaver: Process Piping Design, Vols. 1 and 2; Process Piping Drafting	
DDIV-11 Describing the production and fabrication of structural steel		American Institute of Steel Construction: Manual of Steel Construction; Structural Steel Detailing; Jensen and Helsel: Engineering Drawing and Design; Weaver: Structural Drafting	
DDIV-12 Identifying and billing structural steel plain materials		American Institute of Steel Construction: Manual of Steel Construction; Structural Steel Detailing; Jensen and Helsel: Engineering Drawing and Design; Weaver: Structural Drafting	

CURRICULUM AREA: DRAFTING/DESIGN TECHNOLOGY

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audiovisuals	Textbooks	Student Materials
DDIV-13	Researching specifications, grades and tolerances for structural steel		American Institute of Steel Construction: Manual of Steel Construction; Structural Steel Detailing; Jensen and Helsel: Engineering Drawing and Design; Parker and Hauf: Simplified Design of Structural Steel; Weaver: Structural Drafting	
DDIV-14	Researching properties and detailing dimensions for structural steel		American Institute of Steel Construction: Manual of Steel Construction; Structural Steel Detailing; Jensen and Helsel: Engineering Drawing and Design; Weaver: Structural Drafting	
DDIV-15	Analyzing welding processes and researching welding symbols for structural steel		American Institute of Steel Construction: Manual of Steel Construction; Structural Steel Detailing; Jensen and Helsel: Engineering Drawing and Design; Weaver: Structural Drafting	
DDIV-16	Aiding the structural engineer in designing and drawing framed and seated beam connections (bolted or riveted)		American Institute of Steel Construction: Manual of Steel Construction; Structural Steel Detailing; Jensen and Helsel: Engineering Drawing and Design; Weaver: Structural Drafting	

CURRICULUM AREA: DRAFTING/DESIGN TECHNOLOGY

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
DDIV-17 Aiding the structural engineer in designing and drawing welded framed and seated beam connections		American Institute of Steel Construction: Manual of Steel Construction; Structural Steel Detailing; Jensen and Helsel: Engineering Drawing and Design; Weaver: Structural Drafting	
DDIV-18 Drawing structural steel column details		American Institute of Steel Construction: Manual of Steel Construction; Structural Steel Detailing; Jensen and Helsel: Engineering Drawing and Design; Weaver: Structural Drafting	

CURRICULUM AREA: DRAFTING/DESIGN TECHNOLOGY

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
TSIII-01 Calculating fluid pressure		Harris and Hemmerling: Introductory Applied Principles; Marcus and Thrower: Introduction to Applied Physics; Pollack: Applied Physics; Zebrowski: Physics for the Technicians	
TSIII-02 Calculating fluid velocity		Harris and Hemmerling: Introductory Applied Principles; Marcus and Thrower: Introduction to Applied Physics; Pollack: Applied Physics; Zebrowski: Physics for the Technicians	
TSIII-03 Calculating buoyant force		Harris and Hemmerling: Introductory Applied Principles; Marcus and Thrower: Introduction to Applied Physics; Pollack: Applied Physics; Zebrowski: Physics for the Technicians	
TSIII-04 Describing vibrating systems		Harris and Hemmerling: Introductory Applied Principles; Marcus and Thrower: Introduction to Applied Physics; Pollack: Applied Physics; Zebrowski: Physics for the Technicians	

CURRICULUM AREA: DRAFTING/DESIGN TECHNOLOGY

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
TSIII-05 Defining the structure of matter		Harris and Hemmerling: Introductory Applied Principles; Marcus and Thrower: Introduction to Applied Physics; Pollack: Applied Physics; Zebrowski: Physics for the Technicians	
TSIII-06 Changing units of temperature		Harris and Hemmerling: Introductory Applied Principles; Marcus and Thrower: Introduction to Applied Physics; Pollack: Applied Physics; Zebrowski: Physics for the Technicians	
TSIII-07 Calculating thermal expansion		Harris and Hemmerling: Introductory Applied Principles; Marcus and Thrower: Introduction to Applied Physics; Pollack: Applied Physics; Zebrowski: Physics for the Technicians	
TSIII-08 Calculating heat transfer		Harris and Hemmerling: Introductory Applied Principles; Marcus and Thrower: Introduction to Applied Physics; Zebrowski: Physics for the Technicians	

CURRICULUM AREA: DRAFTING/DESIGN TECHNOLOGY

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audiovisuals	Textbooks	Student Materials
TSIII-09	Calculating thermodynamic coordinates of substances		Harris and Hemmerling: Introductory Applied Principles; Marcus and Thrower: Introduction to Applied Physics; Zebrowski: Physics for the Technicians	
TSIII-10	Calculating work done by heat engines		Harris and Hemmerling: Introductory Applied Principles; Marcus and Thrower: Introduction to Applied Physics; Zebrowski: Physics for the Technicians	

UNIT GUIDE REFERENCES

Textbooks

Ambrose, James, Simplified Design of Building Structures. New York, NY: John Wiley and Sons, Inc., 1979.

American Institute of Steel Construction (AISC), Structural Steel Detailing (2nd ed.). New York, NY: American Institute of Steel Construction, 1971.

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Bassin, Milton G., et al., Statics and Strength of Materials (3rd ed.). Hightstown, NJ: McGraw-Hill Book Company, 1979.

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Davis, Raymond E. and Kelly, Joe W., Elementary Plane Surveying (4th ed.). Hightstown, NJ: McGraw-Hill Book Company, 1967.

Electronic Data Book. Fort Worth, TX: Tandy Corporation (Purchase at Radio Shack).

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Audiovisuals

Audio Active, Inc.	Cassette/tapes
Barr Films, Inc.	Filmstrip/cassettes
Bergwall Productions, Inc.	Filmstrip/cassettes
Cassettes Unlimited	Filmstrip/cassettes
Creative Visuals	Transparencies
DCA Educational Products	Transparencies
Georgia Department of Education	Slide/tapes

ADDITIONAL RESOURCES

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Allyn and Bacon, Inc.
470 Atlantic Avenue
Boston, MA 02210

American Institute of Steel
Construction
1221 Avenue of the Americas
New York, NY 10020

American Technical Publishers,
Inc.
5608 Stony Island Avenue
Chicago, IL 60637

Audio Active, Inc.
Jonesboro, AR 72401
(AV's Distributed by ESP, Inc.)

Avery Products Corporation
Leeds, MA 01053

Barr Films, Inc.
P.O. Box 5667
Pasadena, CA 91107

Bennett Publishing Company
809 W. Detweiller Dr.
Dept. E81
Peoria, IL 61615

Bergwall Productions, Inc.
839 Stewart Avenue
Garden City, NY 11530

Bishop Graphic, Inc.
5388 Sterling Center Dr.
Westlake Village, CA 91359

Bobbs-Merrill Educational
Publishing
4300 West 62nd Street
P.O. Box 7080
Indianapolis, IN 46206

Cassettes Unlimited
Roanoke, TX 76262

Creative Visuals
Gamco Industries, Inc.
Box 1911
Big Spring, TX 79720

DCA Educational Products
424 Valley Road
Warrington, PA 18976

Delmar Publishers
50 Wolf Road
Albany, NY 12205

ESP, Inc.
1201 East Johnson Street
Jonesboro, AR 72401

Goodheart-Willcox Company, Inc.
123 West Taft Drive
South Holland, IL 60473

Gulf Publishing Company
P.O. Box 2608
Houston, TX 77001

Harper & Row Publishers, Inc.
10 East 53rd Street
New York, NY 10022

Interstate
19-27 N. Jackson Street
Danville, IL 61832

John Wiley & Sons, Inc.
605 Third Avenue
New York, NY 10158

Macmillan Publishing Company,
Inc.
866 Third Avenue
New York, NY 10022

McGraw-Hill Book Company
Princeton Road
Hightstown, NJ 08520

McKnight Publishing Company
Box 2854
Bloomington, IL 61701

Pitman Publishing Corporation
6 East 43rd Street
New York, NY 10017

Prentice-Hall, Inc.
Englewood Cliffs, NJ 07632

Prentice-Hall Media
ServCode XF
150 White Plains Rd.
Tarrytown, NY 10591

Reston Publishing Company
11480 Sunset Hills Road
Reston, VA 22090

Robert E. Krieger Publishing
Company, Inc.
P.O. Box 542
Huntington, NY 11743

Southern Building Code Congress
International, Inc.
3617 Eighth Avenue
South Birmingham, AL 35222

Tandy Corporation
Ft. Worth, TX 76102
(Purchase at Radio Shack)

The Datak Corporation
65 71st Street
Guttenberg, NJ 07093

The National Association of
Women in Construction
P.O. Box 6142
Phoenix, AZ 85005

Van Nostrand Reinhold Company
450 West 33rd Street
New York, NY 10001

Wadsworth Publishing Company
10 Davis Drive
Belmont, CA 94002

W. B. Saunders Company
West Washington Square
Philadelphia, PA 19105

APPENDIX B

Special Needs

WORKING WITH SPECIAL NEEDS STUDENTS*

Introduction

Special needs population students are those who are designated as handicapped or disadvantaged. The 1976 vocational education amendments define handicapped individuals as:

> Persons who are mentally retarded, hard of hearing, deaf, speech impaired, visually handicapped, seriously emotionally disturbed, orthopedically impaired, health impaired, or persons with other specific disabilities, who by reason thereof require special education and related services and who cannot succeed in the regular vocational education programs.

In those same amendments disadvantaged persons are defined as:

> Persons (other than handicapped persons) who have academic or economic disadvantages and who require special services, assistance or programs in order to enable them to succeed in vocational education programs.

Federal legislation requires that these special needs population students be given an opportunity to function in regular vocational education programs (Essentially, this is what is meant by the term mainstreaming.). This section provides information on how such students are identified and how they can be mainstreamed into regular vocational education environments.

Figure One presents a conceptual model depicting various activities of the process in identifying and mainstreaming special needs students in vocational education. These activities

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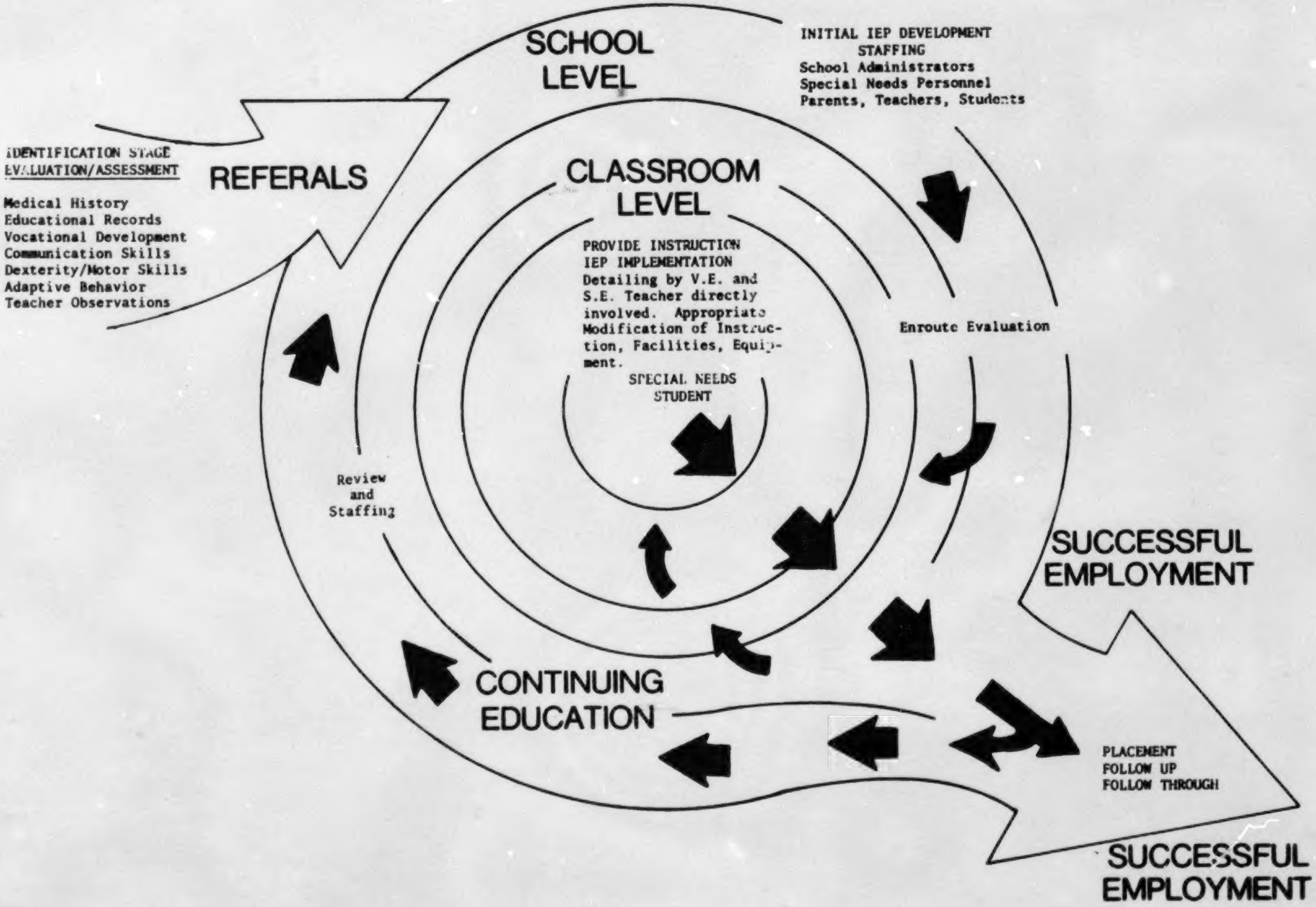
THE CONCEPT OF MAINSTREAMING


SCHOOL LEVEL
INITIAL IEP DEVELOPMENT
STAFFING
School Administrators
Special Needs Personnel
Parents, Teachers, Students
IDENTIFICATION STAGE
EVALUATION/ASSESSMENT
Medical History
Educational Records
Vocational Development
Communication Skills
Dexterity/Motor Skills
Adaptive Behavior
Teacher Observations
REFERALS
CLASSROOM LEVEL
PROVIDE INSTRUCTION
IEP IMPLEMENTATION
Detailing by V.E. and S.E. Teacher directly involved. Appropriate Modification of Instruction, Facilities, Equipment.
SPECIAL NEEDS STUDENT
Enroute Evaluation
Review and Staffing
SUCCESSFUL EMPLOYMENT
CONTINUING EDUCATION
PLACEMENT
FOLLOW UP
FOLLOW THROUGH
SUCCESSFUL EMPLOYMENT

are conducted at three levels: the community level, the school level (Career Development Center) and the classroom level. All three levels must work together if implementation of the process is to be effective.

Identification of the Special Needs Student

Through a variety of pre-testing procedures, special needs students are identified and their potentials are evaluated at the community level. This evaluation process consists of collecting and assessing the following data for each student:

-Medical History
-Educational Records
-Vocational Development
-Communication Skills
-Dexterity/Motor Skills
-Adaptive Behavior
-Teacher Observations

When this procedure has been completed, the community personnel refers the student to the appropriate school level personnel. As a part of the referral and school intake process, an Individualized Educational Plan should be initiated.

> The Individualized Educational Plan (IEP) is exactly what its name implies--a plan for the education of a specific individual. The base content of the IEP is outlined in Public Law 94-142. According to that outline, the IEP must include at least the following information: (a) student's present level of functioning, (b) his/her long range instructional objectives, (c) his/her short-range instructional objectives and finally, (d) some criteria to determine that those objectives have been achieved.

Development of the Individual Education Plan

It would be very difficult to anticipate the exact kind or type of special needs students one might find in a Drafting/-Design Technology program at any one time. The terms disadvantaged and handicapped are really "catch-all" terms that indicate a wide assortment of problems that might occur in a student representing one of these populations. In addition to the lack of a specific definition and the fact that the typical vocational instructor has had very little preparation in working with these students, it becomes clear that you will need a basic plan to use in meeting their occupational preparation needs. The following steps can serve as your basic planning procedure for mainstreaming a special needs population student into your curriculum.

The first step occurs after you have been notified that a special needs student can profit from being in your vocational program. When you have received that notification, you should contact your coordinator of student personnel services and ask for a detailed report of the student's *assessed* status. Note the word *assessed*; it is critical. Through a formal assessment status, appropriate school personnel and community should have identified the student's strengths and weaknesses as well as the specific handicapping conditions. After you have received the assessment information and understand it you are ready for Step Two.

Step Two, developing (or completing) the vocational aspects of the Individual Education Plan-IEP, is usually performed for handicapped students only; however, it has just as much merit for the disadvantaged. The IEP is a very useful tool. It should be considered the description of what you expect that student to be able to do when he or she completes your course and how you will provide the learning experiences to assure that those expected outcomes will be achieved. Be sure that you keep this IEP in a convenient place and *use it*.

The IEP is usually developed through group activities called staffings. Staffings may be held as often as needed and can be used to modify the IEP as the student moves through the program. When a student is about to be mainstreamed into your curriculum, you must become involved in the staffing sessions that will develop the vocational aspects of the IEP. IT IS YOUR RIGHT AND YOUR DUTY, therefore, your being present during the staffings is imperative. The special education personnel can present the student's interests, strengths and limitations. However, only you, the vocational instructor, can relate these to your program. This means that the final statement of the job (DOT) and the task level (short term) objectives are primarily defined by you the vocational instructor.

In Step Three the IEP will first be used to suggest how the curriculum and/or the facilities can be modified to accommodate the special needs population student. Modifying the curriculum means that in most cases special adjustments will have to be made in the student materials and that special instructional strategies will need to be developed. When you say modify the curriculum you are not suggesting that the content be "watered down" - you are proposing alternate ways to teach the proper/required content. REMEMBER! ALL VOCATIONAL EDUCATION PROGRAMS ARE BASED ON REAL JOBS THAT HAVE THEIR OWN TASKS AND STANDARDS. AS FAR AS YOU ARE CONCERNED, YOU HAVE NO POWER TO CHANGE THESE. YOU ALSO CANNOT SUCCESSFULLY CREATE A WHOLE NEW JOB.

Modification of facilities and equipment is a concern when working with the phyically handicapped. Be reminded that by law your school building must already meet requirements of accessibility to all handicapped persons--especially those who are blind or are confined to wheelchairs. Your chief concern is to be sure that your classroom and laboratory will allow the handicapped students to be comfortable and above all to learn. You will also need to make certain modifications that will enable handicapped students to properly and safely use the "tools and equipment of the trade". It is foolish to think that you would have a ready answer for all or any particular one of these physical handicaps--call on the experts. Vocational rehabilitation counselors and other staff have been concentrating on these problems for many years. They should be able to offer a number of positive suggestions. A combination of VR experience and instructor creativity can and has produced outstanding results.

As we think about curriculum modification it would help to review some general learning needs of this population.

> The educationally mentally retarded will constitute a major population now entering vocational education. The key concept to remember in modifying the curriculum for this population is that they require much more detail in order to learn and they require a great deal more practice time. All curriculum modifications for these groups should be made by detailing each task or objective into its smallest parts and by providing for more and more practice.
>
> The hearing and visually impaired can be accommodated by common sense and the use of supporting resource personnel. Neither of these groups reads well or learns from reading as a primary mode. This should be accounted for in modifying the curriculum, i.e., larger print, brail and recordings for the blind and captions on visual materials, seating arrangements, use of notes from a classmate, lower reading level textbooks, oral testing and total communications for the deaf.

The orthopedically handicapped usually require attention to facilities and equipment. Beyond that, their learning needs are as varied as those of the normal population. Remember, some of these individuals will actually be highly gifted in their chosen field. Their major needs will be psychological and coping with the school environment.

The disadvantaged are physically and mentally capable of learning, but their background has not allowed them to fully develop the discipline and cognitive skills (i.e., vocabulary, math, etc.) required to master occupational preparation courses. They have also developed an anti-school attitude that complicate many efforts to modify the curriculum for them. Usually their success in the vocational program is contingent on either a good pre-vocational program or a supporting academic program.

Step Four requires that instructional strategies be selected. These strategies may be many and should be varied. They should reflect the best learning technique for a given student and his or her chosen occupation. Some examples of instructional strategies are discussed below.

Teacher demonstration: Simply show the student how the job is to be done in clear distinct steps.

Peer demonstration: This technique allows the instructor to use one of the advanced students to demonstrate a particular task in a step by step fashion. It is a flexible system. For example, you can use peer demonstration to show each task step while you explain them to the students. When working with the mentally retarded, you will never have enough time to demonstrate a task as often as they may need to see it. In such situations, the well prepared advanced student can perform and explain the same demonstration several times.

Shadowing: Shadowing can be used in conjunction with demonstrations. By shadowing, the student is allowed to do exactly what the demonstrator does. This allows the student to learn in a see and do fashion. The student may shadow the instructor, an advanced peer or in some instances the worker on the job.

Job site visits: Job site visits offer the student an opportunity to see the work being done in its natural location. Students can develop a worker identify a realistic view of how the tools, equipment and materials are brought together to produce the product.

Work group or team: By being a part of a work team, the student can learn the various roles in an occupation as having the opportunity to practice specific sets of skills under the tutelage of peers.

Individualized instruction: Appropriately prepared or adjusted individualized instruction is a big help in managing a class that contains a mixture of special needs population students and "norm group" students. Individualized instruction, no matter what the source, will require much developmental input from the instructor. In most all cases, however, the results are worth the effort.

Media: Many of the special needs populations require mediated instruction (i.e., hearing and visually impaired), however, the use of appropriate media enhances learning for all students. Media can range from a line drawing in an instructional module, to a video tape, to posters and charts. It can be instructor made or commercial. All that matters is that it exactly links to the objective.

Project Method: The value in using projects with special needs population students is that they help them mentally and physically unify all the parts into a uniform whole. Because of the detail required for them to learn, they need learning activities that relate all of the parts to the whole. The development of a product through an assigned project is an ideal integrating experience.

Simulations: Simulations meet a variety of instructional needs. One of the more important with special needs population students is providing the opportunity to develop proper safety concepts before actually working with the "live" equipment that could be dangerous to a careless student.

Role playing: Role playing is a part of several other instructional strategies. On its own, it is a very good procedure for developing the attitudes and values required of a successful worker-i.e., a sense of responsibility, the ability to take orders and follow directions, interpersonal skills and so on. It is a way to concentrate on developing good work habits and positive attitudes.

Peer instruction: Like peer demonstrations, peer instruction is able to multiply the instructor's available time. This allows individual students with specific needs to have more assistance. Peer instruction has values beyond expanding time; it is an excellent approach to learning. In almost every situation, both the peer teacher and the peer student profit from the exchange. In operation peer instruction is simply a matter of preparing and allowing one of the advanced students to teach small groups certain segments of a course.

Team teaching: As we have already noted, some special needs populations require a combination of vocational and special education presented in harmony. A team approach is the only way to meet that need. For team teaching to be effective, clarification of student needs (as defined by the IEP) and careful planning will be required.

Peer apprenticeships: The peer apprenticeship is an ideal way to induct the new special needs population student into the curriculum. By serving as the apprentice to an advanced student, the special needs population student can become climatized to the laboratory/shop and can begin to learn the tools, equipment and materials of the program. The shadow technique can also be added to increase hands-on learning.

Assessment and feedback: Student learning can be improved by frequently assessing students' skills and feeding back their strengths and weaknesses. Through a process of positive feedback, the student can be moved gradually from where he or she is to the level of skill required.

These instructional strategies can be used independently or in various combinations. This brief list is meant only to provide you with some suggestions, there are no doubt many other techniques that could be used. The creative instructor will be constantly innovating to meet the needs of particular students.

Implementing the IEP

Step Five is a matter of putting the vocational aspects of the IEP into operation. The activation of the IEP initiates the student into the vocational education program and allows him or her to progress through the modified curriculum at his or her optium rate. There should be frequent assessment activities that indicate where the student is relative to the IEP objectives. If problems are detected, a staffing should be conducted to re-evaluate the IEP and continue the process in a fashion that is most beneficial to the student.

Step Six will take the student to his or her next logical step of either totally exiting the system or recycling into a continuing education mode. In most cases, the student will do some of both--getting a job and periodically accessing the continuing education component of the educational system to refine existing skills or to broaden his or her capacity.

The ultimate goal of all this effort is not employment-rather it is "successful employment". **Successful employment** implies that not only is the student placed in a job, but that the student is able to sustain himself or herself in a working environment over an extended period of time.

Evaluation

Evaluation of the student's program is a critical step. Through that process we not only help the current student, but we are able to gather information that will improve our potential to help students with similar difficulties in the future. A well rounded evaluation system should consist of the following activities:

-En-route evaluation (formative) to monitor the student's progress through the program.

-Summative evaluation upon completion of the program to determine job readiness.

-Follow-up after placement to determine if the student is successful on the job.

-Follow-through activities designed to identify any further training needed, which may be indicated by the follow-up procedure.

RESOURCES

In recent years, mainstreaming of special needs population students has been an area of great concern to vocational educators. The overall result of that concern is an abundance of well developed resource materials and a variety of personnel with special skills in working with these groups. In the space allowed by this curriculum guide, it would be impossible to present an adequate set of methods and procedures for solving the problems of students with special needs, but if the vocational education administrator and instructor will judiciously use the human and material resources listed here, much of the in-depth information required for the special and unique cases that will occur can be compiled from these sources.

Support Personnel or Systems

As was noted earlier, you the vocational instructor, simply do not have sufficient skills to work with special needs population students alone. There are too many different student problems to ever allow an instructor to deal with them all on a "come as you are" basis. For that reason, you must make yourself aware of the variety of support systems and personnel that are available to you and to the students. A few of these are listed here. These specialists can lead you to others on an as needed basis.

> County Health Department - Many of your special needs population students will need some medical and dental assistance. The county health facility is an excellent referral source for these problems.
>
> Special Education - Through local boards of education there are a variety of special education personnel available locally, regionally and from the State Department of Education. The vocational education administrator can obtain assistance from these specialists through the local superintendent's office.
>
> Project SERVE - Project SERVE is a statewide effort to acquire materials and to cultivate expertise in providing vocational education to disadvantaged. Project Serve can

be contacted by the area vocational-technical director or the vocational supervisor.

Vocational Rehabilitation - Vocational rehabilitation is a highly developed organization whose major focus is all dimensions (such as: diagnosing, training, job placement and counseling) of the handicapped population. Within that network is a vast pool of expertise. You can contact it through the area vocational rehabilitation counselor who calls on your school or through a designated school official such as the coordinator of student personnel services or Career Development Center personnel.

Office of Student Personnel Services - In the area vocational-technical school, this is the key group as far as students and student needs are concerned. They can provide a variety of services to you and to your students. Many of the contacts with community agencies have already been made by this group-that alone will save the instructor much time.

Career Development Center - Each area vocational-technical school has a Career Development Center designed to meet the very special needs of incoming disadvantaged and handicapped students. The CDC staff is available to assist the instructional staff with a wide range of services for the special needs student populations.

All of the resources and resource personnel listed here are a part of the team. The best results can be obtained by using as many of these people and their support systems as possible from the beginning. In some situations, you will miss a resource in the beginning or the student's needs change. When that occurs do not hesitate to call on the appropriate experts for additional help. As a matter of fact, the rule of thumb that has always been used in the "helping professions" is to go as far as you can, then refer. Do not hesitate to call for help. Most of these service groups are funded to support "your" student. If you do not use them, they fail in their mission and you fail in yours.

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-CVET Construction	3100219	Teacher's Guide
	3100209	Student
-CVET General Mechanics	3100219	Teacher's Guide
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APPENDIX C

Definition of Terms

DEFINITION OF TERMS

1. A/Vs-Audiovisuals - May refer to any picture and/or sound media. (ie. slides, tapes, filmstrips, 16 mm films, etc.)

2. Checkpoint - A student-instructor interface point wherein the instructor may give the student a test, perform a demonstration, or simply provide the student with additional needed information or instructions. Also a checkpoint may be used for motivational purposes.

3. Competency - The ability (knowledge, skills and attitudes) to perform all of a group or cluster of related tasks required to complete a designated activity according to occupational standards. In the educational setting, the statement of a competency includes expected student outcomes in terms of knowledge, skills and attitudes required to complete a designated activity as defined by incumbent workers according to the standards of the work place.

4. Course - A grouping of tasks and competencies which have a common knowledge base or are within a given domain.

5. Criterion-Referenced Measure - An exercise based upon a performance objective, the accomplishment of which measures attainment of that objective.

6. Criterion-Referenced Test - A test designed to measure student competencies based on job or industrial standards.

7. Curriculum Guide - A document containing the objectives, content, organization and structure of an instructional program. It is designed for use by administrators, instructional supervisors and teachers.

8. D.O.T. - Abbreviation for Dictionary of Occupational Titles. Document provides nine digit codes identifying each occupation.

9. Duty - One of the distinct major activities involved in the work performed. A Composition of related tasks.

10. Exit Point - A pre-determined point within an instructional program in which a student may exit with the essential competencies for a specific job. Usually defined in terms of D.O.T. codes and/or O.E. codes.

11. "Hands-On" - Statement implying the student is physically involved in a learning activity.

12. Individualized Instruction (I.I.) - A system of instruction allowing a student to progress at his/her fastest rate.

13. Job - A specific area of specialization within an occupational field consisting of several closely related duties for which a person would expect to receive remuneration. Should be identified by DOT code.

14. Job Sheet - (Or Operations Sheet) - A project of a performance nature. Generally performed by the student in a lab or shop type environment or in a specialized work area.

15. Live Work - Generally refers to items brought into the course area for repair or adjustment. Examples of live work might be automobiles, radios and TV's, air-conditioners, etc. Another form of live work would be patrons visiting the cosmetology department to receive permanents or other services.

16. Master Copies - Original copies of slides, tapes or written materials set aside for the purpose of duplication.

17. Occupational Cluster - A group of occupations sharing a common core of competencies. Georgia's comprehensive high school vocational program is organized around this concept.

18. Occupational Inventory - A listing of tasks to be performed in a particular occupational area, grouped under duty classifications.

19. O.E. - Refers to the U.S. Office of Education. O.E. codes are a classification system (taxonomy) for occupational education programs.

20. Open Entry - Term meaning that a student may enter the program at any time and does not have to wait for quarter or semester breaks.

21. Open Exit - Term meaning that a student may leave a program any time he/she completes occupational objectives.

22. Performance Guide - A series of steps arranged in a sequence which when completed may result in the performance of a task. Also called teaching steps.

23. Performance Objective - A statement in precise, measurable terms of a particular behavior to be exhibited by a learner underspecified conditions. It possesses each of the elements or characteristics specified below:

    a. Condition - The testing situation confronting the learner is clearly specified. This includes equipment provided or withheld, environmental constraints such as temperature, space, etc.

b. Performance - The specific behavior expected of the learner is stated.

c. Standard - The degree of acceptable performance is specified.

24. Performance Test - A test entailing not only the ability to answer questions, but measuring the student ability to operate, manipulate or perform a given task.

25. Program - An organized sequence of courses leading to an occupational objective. A program may contain one or more student exit points as defined by D.O.T. codes.

26. Program Objective - The outcome of a prescribed program of instruction. Usually expressed in terms of the occupation or job for which training is designed. D.O.T. codes are frequently used to identify program objectives or student exit points.

27. Self-Paced - Refers to a student moving through the prescribed training program at the fastest pace at which he/she can meaningfully learn.

28. Sequencing - Putting any set or series of learning activities or tasks into proper order or sequence. Normally arranged from simple to complex within groupings or blocks.

29. Software - Written or printed materials, slides, filmstrips, tapes, etc.

30. Student Manual - A document designed for use by students in a specific instructional program. It contains unit sheets, references, operational procedures, job sheets, etc.

31. Task - The smallest division of work in which a measurable output occurs. A logical and necessary step in the performance of a duty.

32. Task List - A listing of tasks performed by incumbent workers within a domain of interest. An example is a listing of all tasks performed by an automotive mechanic or by a worker in ornamental horticulture.

33. Unit - One "module" training material that generally covers one learning task and programmed on one unit sheet. May cover more than one lesson.

34. Unit Guide - A curriculum guide sheet that lists a task and objective with the instructional activities, instructional materials, evaluation and approximate time required for a student to successfully complete the task.

35. V'TECS Catalog - A comprehensive collection of performance objectives, performance guides, criterion-referenced measures and related data. Organized by a job structure or career ladder within a domain of interest.

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The following individuals have been designated as the employees responsible for coordinating the department's effort to implement this nondiscriminatory policy.

Title II - Loydia Webber, Vocational Equity Coordinator
Title VI - Peyton Williams Jr., Associate Superintendent of State Schools and Special Services
Title IX - Evelyn Rowe and Myra Tolbert, Coordinators
Section 504 - Jane Lee, Coordinator of Special Education

Inquiries concerning the application of Title II, Title VI, Title IX or Section 504 to the policies and practices of the department may be addressed to the persons listed above at the Georgia Department of Education, State Office Building, Atlanta 30334; to the Regional Office for Civil Rights, Atlanta 30323; or to the Director, Office for Civil Rights, Education Department, Washington, D.C. 20201.